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TOWARD REGULATORY REASONABLENESS

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U.S. DEPARTMENT OF COMMERCE
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TOWARD REGULATORY REASONABLENESS

U.S. DEPARTMENT OF COMMERCE
Elliot L. Richardson, Secretary

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INTRODUCTION

In the latter half of 1975 and early 1976, a new catch-phrase for an area of public policy interest seemed to be of emergent general concern: "regulatory reform." That concern has lately seemed to have diminished--lost, with many others, in the shifting swirl of media attention given first to Presidential politics and now to the politics and personalities of transition. In time--indeed, soon--attention will shift again. And "regulatory reform" (under some such heading), along with other major national issues of substance, will return to a visible position on the national agenda.

The legislative calendar virtually assures that this will be the case, with early Congressional action likely on major issues of environmental regulation: most notably, the pending amendments to the Clean Air Act and the Federal Water Pollution Control Act. The character of these amendments promises fundamentally to affect not only the quality of our natural environment but, at least potentially, the pattern of U.S. economic and social development. Even if the legislative calendar did not suggest their likely return to visibility, these issues would be forced upon the national agenda by their inherent importance--and their inescapable association with the development of modern industrial and "post-industrial" society.

When the debate is reopened, one must hope that it may proceed on a more rational basis than when last it was visible--hence, the title of this paper: Toward Regulatory Reasonableness. Indeed, it would be difficult for debate not to be more rational than it has typically been with regard to major regulatory issues.

This was impressed upon me particularly by the Clean Air Act debate in the latter portion of the last Congress. As a new Secretary of Commerce, and one who was new to this debate, I was somewhat surprised to discover buried in a staff economist's memorandum a bland note that the pending Clean Air Act amendments could mean the end of U.S. economic growth. If any reasonably plausible analysis could support this assertion--as, given certain assumptions, it might--then, at a minimum, it could be said that, as a society, we were misleading ourselves about the nature of the issues before us. For the debate could not properly be cast as a "clean air" debate--as in general it was--when in fact it also involved fundamental issues of economic (and indirectly, of social) development, issues which surely should merit direct and explicit treatment. And if there were a respectable divergence of opinion as to the character of the economic effects which might be involved--as, upon examination, it was clear that there was*--then clearly it was at best unfortunate that, as a society, we would seriously consider such potentially far-reaching legislation without further study.

The tendency to proceed dramatically without clearly identifying possible consequences and without an adequate factual base, as suggested by the clean air example, is hardly unique. Nor is it the only respect in which our approach to regulatory policymaking may properly be viewed as irrational.

Indeed, it has been obvious that the very tone of the debate has often been excessively emotional, self-righteous, simplistic and ideological. The phrase "regulatory reform" itself has become a codeword, capable in some quarters of engendering immediate excited reaction.

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* At Appendix C is a review of major studies of the possible effects of Clean Air Act amendments.

The phrase, of course, is so vague as to embrace a wide range of interests. (In this respect, "regulatory reasonableness" is hardly better--except that it suggests a less ideological quest.) For some, "reform" has meant tighter governmental regulation and more distant connection between regulators and regulatees; for others--the "de-regulators"--it has meant far looser governmental regulation and greater reliance on the disciplinary forces of the private marketplace. Often the differing would-be reformers have addressed themselves to entirely different substantive problem areas; and it should not have been surprising that their differing procedural recommendations would seem so far apart.

Nonetheless, the emergent character of the policy debate (when last it was visible) was increasingly polarized. There were those ostensibly for the "public interest," e.g., protection of the environment and the consumer, and those ostensibly for "private interests"--as if these were neatly and simply opposed.

The polarization involved a fair degree of apparent anomaly and confusion. Some public interest advocates showed great sensitivity to consumer price effects in areas of traditional economic regulation, but relatively little sensitivity to consumer price effects in areas of environmental regulation; great concern for the regulation of workers' health and safety, but relatively little visible concern for the effects of regulation upon the very existence of workers' jobs. Similarly, private interest advocates showed great positive interest in the application of "deregulatory" principles to environmental health and safety areas--matched, however, by a visible negative interest in deregulating areas of traditional economic regulation, where protected economic interests might have been threatened.

But more fundamentally, the presumption that "public" and "private" interests could be neatly separated and opposed was itself--and it remains--a basic confusion. This is particularly problematic in the emergent area of environmental, health and safety regulation. The simple fact is that jobs, prices, health, safety, environmental

protection--these are general interests, both public and private. On particular issues, the weighting of concern among these interests may vary among different concerned parties. But it borders on the ridiculous--and it is, in any case, unhelpful--to suggest that one class of concerns or one class of concerned parties might be exclusively representative of "the public interest." The public interest includes interests in jobs and prices and health and safety and environmental protection. It derives from the fact that these interests are all widely shared private interests--which the private marketplace alone cannot adequately serve.

The practical point of difficulty is that in a world of limited resources--our world--these general interests are often in competition with one another. And what requires attention is not some drastically oversimplified choice between private and public interest (as if these were perfectly clear) or between market and non-market solutions (as if the alternatives should be so stark). What requires attention is the need for an improved regulatory policy system--to expose more fully relevant issues, interrelationships and facts; to represent more fairly competing general interests; and to determine more satisfactorily the preferred balance for their resolution.

This paper is intended to help focus attention on the need for such systemic reform. It is more concerned with the transcendent issues of process which determine the substantive character of regulations than with individual regulations themselves.

The paper concentrates on environmental, health, and safety regulation. That is, it does not treat traditional economic regulation, as in the areas of transportation and energy; nor does it treat a widely irritating problem often associated with regulation, the excessive burden of "red tape" and paperwork. The latter is of less significance in economic terms; but its aggravating characteristics seriously disturb the climate of public sector-private sector relations. However, it is well understood now to be a problem--and steps have been taken to address it through the Commission on Federal Paperwork and through the President's Management Initiatives program. The former, traditional economic regulation, has received a high degree of analytic attention and is relatively well understood intellectually--even if there is not yet political consensus on how best to proceed.

The area of environmental, health and safety regulation--which is unquestionably of major economic and social import--is, by contrast, not yet well understood. In part, this is because of inherent scientific and methodological difficulties. But importantly it is because the proliferation of governmental regulatory interventions in this area is largely a recent phenomenon--the very scope of which is not yet even widely appreciated. Direct governmental expenditures in this area, although increasing, remain relatively modest. But the private resources redirected by governmental regulatory action are not modest at all. They are now roughly comparable to direct expenditures for defense procurement, or twice the federal expenditures for education, training, employment and social services.

And, one might well suggest that like newly emergent defense programs in the late 1950s and early 1960s, and like emergent social programs in the late 1960s and early 1970s, the recently emergent areas of environmental, health and safety regulation are now in need of improved policy analysis and policy development systems.

The paper gives what might be viewed as disproportionate attention to the costs of environmental, health and safety regulation--and less attention to benefits than one might wish. In part, this is because empirical information about benefits remains highly fragmentary--a problem which requires systematic attention. In part, it is because assessment of benefits involves difficult problems of value judgment--problems which empirical analysis alone cannot address. And in part, it is because cost information--itself heretofore, and to some extent still, highly inadequate--is more easily identified.

It is important that the costs of regulation be better appreciated--and in this respect the paper makes a useful contribution, synthesizing information not previously brought together.

But the relative emphasis given to costs should not in any way be taken to suggest that the current or projected costs of environmental, health and safety regulation make the regulation unjustifiable. The extreme form of this position would, of course, be absurd; for some amount of environmental, health and safety regulation is clearly essential for a modern society: the market alone cannot do the job which the continued health of our society requires.

The more complicated question is: "How much is enough?" This, of course, is the same general question which has seriously troubled defense policy analysts since the 1950s. The paper does not answer this question. The question involves problems of empirical evidence, problems of judgment and problems of values. The paper seeks only to present some of the relevant empirical evidence and to discuss the way in which our system develops and acts upon such evidence. It leaves the problems of values and judgment, however, to the political system.

The paper makes clear that the costs of supporting our environmental, health and safety values are very high indeed. But it must, of course, be equally clear that no cost is necessarily "too high"--provided society is willing and able to pay it. And these costs, though high, appear to be within a plausible range of our likely ability to pay--provided we are willing to sacrifice the allocation of resources to other possible values. For the investment required by environmental, health and safety regulation could, of course, be put to alternative uses--ranging all the way from expanded productive capacity and less inflation to government taxation and, say, income redistribution.

What is inescapably involved is a matter of choice. And this paper seeks simply to help move us toward a system in which the elements of choice are more fully exposed.

This paper does not offer detailed solutions. Rather, it simply points to directions for possible improvement in our regulatory system--directions toward regulatory reasonableness. Had the present Administration remained in office, detailed work on solutions would have continued, and this report would probably not have been released until that detailed work were further developed.

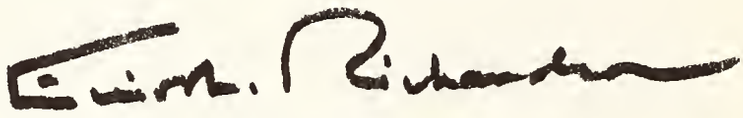
Given the current transition, however--and with the public debate on environmental, health and safety regulation about to resume--I would hope it may be helpful to the debate that this work-in-process is now placed in the public domain.

The debate, of course, will be an extended one. Environmental, health and safety problems will not go away. Indeed, they will demand increasing attention as our economy continues to develop. This is partly because development itself tends to compound the problems. But it is also importantly because economic development, beyond the point where traditional basic needs are satisfactorily addressed, brings with it increased sensitivity to higher needs--including needs not only for improved health and safety, but for greater aesthetic satisfaction. Many of these needs can only be satisfied through one form or another of collective action and collective choice.

We have only recently begun to develop our approach to the management of these emergent problems of choice. And it is natural that our starts have been somewhat clumsy. One must hope--and, indeed, one should expect--that the system we evolve for choice and action will move in directions that are more fully and efficiently democratic, and more thoroughly informed.

The shaping of such a system will require--as, I am pleased to note, the incoming Chairman of the Council of Economic Advisers, Charles Schultze, has recently argued--that there be a "rebuttable presumption" in favor of private market-oriented

incentives. As a complex society interested in preserving both the values of the marketplace and certain human, social and environmental values, America will have to invent new means of intervention--means which mix direct regulation with more market-oriented incentives--in order to foster a more efficient and more creative inter-relationship of the public and private sectors. In any case, regulatory policy development will require significant improvement in the current quality of analysis. This report will have served its purpose if it provides further impetus toward such improvement.



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Overall responsibility for the contents of this report, however, remains our own.

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I. TOWARD REGULATORY REASONABLENESS

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A. "BIG GOVERNMENT" IN PERSPECTIVE; AND THE LIMITS OF "CORPORATE RESPONSIBILITY"

This section is in two major parts. The first--The Growth of Big Government (pp. 10-27)--briefly provides perspective for consideration of environmental, health and safety regulation with regard to the more general concern for "big government." The second--The Limits of Corporate Responsibility (pp.28-33)--provides perspective on the extent to which reliance on "corporate responsibility" might reasonably be expected to address either the "big government" problem generally, or the problems of environment, health and safety in particular. Together, these two perspectives comprise an argument as to both the importance and the likely inescapability of environmental, health and safety regulation--and serve, thereby, to provide a frame through which to view the analysis which follows.

The Growth of "Big Government" and Environmental, Health and Safety Legislation

That government has somehow grown "too big" has become a widespread and even hackneyed observation--a perspective shared now by the leadership of both major political parties. While valid in several respects as a general observation, it is one which requires analysis if it is to be sensibly interpreted. For the matter is not as simple as those concerned with "burgeoning budgets" and "sprawling bureaucracy" might suggest.

It is, of course, obvious and indisputable that, by several conventional measures, government has been growing:

- In current dollars, the federal budget has grown from 41 billion in 1950 to 358 billion in 1975; and all government expenditures have increased from 61 billion to 531 billion.
- In the same 25 year period, federal government employment has increased from 2.0 million employees to 2.8 million; and all government employment has increased from 5.7 million to 13.0 million.
- The ratio of public sector employment to total civilian employment has increased from 12.2 percent in 1950 to 18.1 percent in 1975.

- Stated somewhat more dramatically these figures might be read to suggest that: "In the past quarter century, government spending has increased nine-fold; and now almost one out of every five workers is employed by the government."

Although accurate as stated, these points do need to be put in better perspective, for they--and the current conventional wisdom with which they are often associated--are misleading in several respects:

- First of all, they require adjustment for inflation. Measured in constant (1972) dollars, the growth in total government spending from 1950 to 1975 becomes a three-fold increase--as opposed to the unadjusted nine-fold increase.

- Viewed in another way--measuring, in constant dollars, total government spending as a percent of Gross National Product (GNP)--the increase from 1950-1975 has been more modest, from 25.8% to 32.5%. The federal component of this measure (including grants-in-aid to states and localities but excluding transfer payments) has hardly increased at all in the past two decades--21.6% in 1955 to 21.9% in 1975.

- Although the conventional wisdom emphasizes the growth of the federal "central" government, the larger portion of the growth has been at the state and local ("decentralized") levels of government. If grants-in-aid to states and localities are removed from federal expenditures, federal expenditures since 1955 show a net decline of 2.2 percentage points since 1955. Federal employment, as a percentage of total civilian employment, has also declined--from 4.3 percent in 1950 to 3.9 percent in 1975; whereas the proportion for state and local government employment has doubled--from 7.9 percent to 14.2 percent. In absolute terms, federal employment in this 25 year period has increased by 800 thousand, whereas state and local government employment has increased by 6.5 million employees.

- The forms which the increase in governmental expenditures have taken also merit consideration. A major component of the increase in governmental expenditures has been in transfer payments--which now excede 10% of GNP--essentially a check-writing form of government, as opposed to that ordinarily associated with a "heavy hand." The second major component of the increase has been in the form of federal grants-in-aid to states and localities--which have more than tripled as a percentage of GNP, from 1.1% in 1950 to 3.5% in 1975. Here it is noteworthy that there has typically been a "heavy hand" effect--but that it has fallen primarily on other units of government.

- And further, the implication that past rates of increase in governmental expenditure promise the continuation of such trends requires considerable qualification. The largest category of growth in public expenditures in the past twenty years has been social human investment. It has grown from 31.5% of total public sector expenditures to 54.0%--whereas national defense has decreased from 39.9% to 18.1%. The trend in defense expenditures will have to be modified somewhat--if only to keep up with inflation, and to correct for the sacrifices in modernization which helped to finance the Vietnam War. But public attitudes seem likely to limit seriously the growth of defense expenditures. Similarly, public attitudes seem likely now to limit the rate of increase in social human investment programs. Even if this were not the case, the rate of increase would likely be slowed. Grants-in-aid for education and public assistance comprise nearly half the total; and growth in these should slow because the rapid growth in school enrollment is not likely to continue, and because participation rates for welfare programs have now risen to approximately

> 90% of the eligible population. The major expansion of transfer payments, particularly in social security, has also begun to approach its limits--as, on the one hand, coverage has been widely expanded and benefit levels have been adjusted upward significantly; while, on the other hand, resistance to further social security tax increases has also markedly increased. And although welfare reform and national health insurance may require increased expenditures in those programmatic areas, they can be expected to relieve somewhat the pressures for expansion of categorical programs which might otherwise increase on grounds of both need and equity. In short, as always, the past is a highly imperfect guide to the future. Sensationalist extrapolations are not appropriate. It is highly probable that the rate of growth of governmental expenditures for the coming quarter century will be considerably less than it has been in the past one.

These points of qualification suggest that "big government" (or "Washington")--measured in terms of expenditures and employment--is, from some perspectives, neither so big nor so likely to become monstrous as conventional wisdom would argue.

On the other hand, it is obviously the case that the absolute growth of American government in the middle third of the twentieth century--however it may be discounted by relativist argument--has brought with it problems attributable to scale. With increased scale there is increased complexity. In the absence of adequate technological adaptation--an absence which has been characteristic of the public sector--these increases compound the burdens of governmental responsiveness, and compound the image of government as a pitiless, unhelpful giant. They also render government less readily comprehensible and, thereby, compound individuals' sense of alienation from government.

Notwithstanding these thoroughly valid points about the inherent problems of increased governmental scale, there are two further lines of qualitative argument which tend to suggest that a focus on the "bigness" of government, viewed in terms of expenditures and employment, may be misplaced.

The first line of argument is simply this: that rising antipathy toward the "bigness" of government is overstated, insofar as it is a symptom of more general alienation, for which an oversimplified focus on a ready target--"government"--provides an outlet for relief. Other elements of the general alienation, in some ways more unsettling for individuals, are harder to focus upon. They include the increase in transiency, the increase in the apparent pace of change, the decline of the family, the destruction of neighborhoods, and the loss of a "sense of community." Arguably, American society is now in the process of healthily adapting to, or modifying, these trends. But be that as it may, they have been, and they remain, deeply troublesome. The growth of government has been partly a cause of these trends--but partly a consequence, and partly too an independent phenomenon consciously and unconsciously blamed, from time to time, as if it were the sole cause of modern alienation.

The second line of argument is the essential entry point for this paper: A proper perspective for the analysis of "big government" (one which has not yet been treated adequately as such) must focus on the recently emergent role of the central government ("Washington")--not as a taxer or a spender or an employer--but as a direct prophylactic, social and aesthetic regulator of the human work and leisure environment. This, of course, is not an entirely new kind of role for the federal government. But in the past decade and a half, the change in degree has been fundamental.

That this is not a matter properly viewed in terms of federal budgets or employment should be obvious. The point is suggested by considering the relative effects of the past decade's civil rights social regulatory interventions versus the "Great Society" social expenditure programs. The federal expenditure and employment allocations for the former have been trivial by

comparison with the allocations for the latter. But it would not be stretching a point much to suggest that, in terms of effects, the relationship has been roughly the reverse--i.e., the effects of "great society" social program expenditures have been close to trivial by comparison with the effects of civil rights regulatory intervention. Or perhaps more to the point: A very few executive branch employees have the authority, as an obvious example, directly to regulate emission standards for all new automobiles--with the indirect authority, thereby, to regulate not only air quality, but also the fundamental patterns of private automobile production, purchases and use. It is similarly noteworthy that the federal Occupational Safety and Health Administration (OSHA) has authority to regulate almost every conceivable characteristic of over 5 million private workplaces--with an annual budget of less than $100 million and total employment of slightly more than 2000.

The point is not that federal budgets and employment allocations are somehow out of line. The point is that in areas of regulatory policy they are largely irrelevant. For it is private resources and private patterns of behavior which are reoriented--often on a major scale--by low-budget federal actions of regulatory standard-setting and enforcement. What is relevant is the scope of federal authority for regulatory intervention--and the process by which it is exercised.

And in the past decade and a half the proliferation of federal authorities for environmental, health and safety regulation has been dramatic--and, to a considerable extent, under-appreciated. Total resources (overwhelmingly private) now expended in this emergent regulatory area now exceed those allocated to defense procurement, and are double the federal expenditures for education, training, employment and social services. But, perhaps more importantly, the reach of federal regulatory authority is into virtually every element of the "private" sector.

A partial list of environmental legislation enacted in the past decade and a half includes the following:

- Water Resources Research Act of 1964 (P.L. 88-379 - 7/17/64). To establish water resources research centers, to promote a more adequate national program of water research, and for other purposes.

  In order to assist in assuring the Nation at all times of a supply of water sufficient in quantity and quality to meet the requirements of its expanding population, it is the purpose of the Congress, by this Act, to stimulate, sponsor, provide for, and supplement present programs for the conduct of research, investigations, experiments, and the training of scientists in the fields of water and of resources which affect water.

- Water Resources Planning Act (P.L. 89-80 - 7/22/65). To provide for the optimum development of the Nation's natural resources through the coordinated planning of water and related land resources, through the establishment of a water resources council and river basin commissions, and by providing financial assistance to the States in order to increase State participation in such planning.

  In order to meet the rapidly expanding demands for water throughout the Nation, it is declared to be the policy of the Congress to encourage the conservation, development, and utilization of water and related land resources of the United States on a comprehensive and coordinated basis by the Federal Government, States, localities, and private enterprise with the cooperation of all affected Federal agencies, States, local governments, individuals, corporations, business enterprises, and others concerned.

- Solid Waste Disposal Act (Title II of P.L. 89-272 - 10/22/65) (as amended by the Resource Recovery Act of 1970, P.L. 91-512 - 10/26/70 and P.L. 93-14 - 4/9/73). (1) To promote the demonstration, construction, and application of solid waste management and resource recovery systems which preserve and enhance the quality of air, water, and land resources; (2) to provide technical and financial assistance to States and local governments and interstate agencies in the planning and development of resource recovery and solid waste disposal programs; (3) to promote a national research and development program for improved management techniques, more effective organizational arrangements, and new and improved

methods of collection, separation, recovery, and recycling of solid wastes, and the environmentally safe disposal of non-recoverable residues; (4) to provide for the promulgation of guidelines for solid waste collection, transport, separation, recovery, and disposal systems; and (5) to provide for training grants in occupations involving the design, operation, and maintenance of solid waste disposal systems.

- Clean Air Act (42 U.S.C. 1857 et seq., as amended by the Air Quality Act of 1967, P.L. 90-148, by the Clean Air Act Amendments of 1970, P.L. 91-604, by Technical Amendments to the Clean Air Act, P.L. 92-157, by P.L. 93-15 and by P.L. 93-319). (1) To protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population; (2) to initiate and accelerate a national research and development program to achieve the prevention and control of air pollution; (3) to provide technical and financial assistance to State and local governments in connection with the development and execution of their air pollution prevention and control programs; and (4) to encourage and assist the development and operation of regional air pollution control programs.

- Air Act to Require Aircraft Noise Abatement Regulation (P.L. 90-411 - 7/21/68). To amend the Federal Aviation Act of 1958 to require aircraft noise abatement regulation, and for other purposes.

  In order to afford present and future relief and protection to the public from unnecessary aircraft noise and sonic boom, the Administrator of the Federal Aviation Administration, after consultation with the Secretary of Transportation, shall prescribe and amend standards for the measurement of aircraft noise and sonic boom and shall prescribe and amend such rules and regulations as he may find necessary to provide for the control and abatement of aircraft noise and sonic boom, including the application of such standards, rules and regulations in the issuance, amendment, modification, suspension, or revocation of any certificate authorized by this title.

- The National Environmental Policy Act of 1969 (P.L. 91-190, as amended by P.L. 94-52 and P.L. 94-83 - 1/1/70). (1) To declare a national policy which will encourage productive and enjoyable harmony between man and his environment; (2) to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; (3) to enrich the understanding of the ecological systems and natural resources important to the Nation; and (4) to establish a Council on Environmental Quality.

- Environmental Quality Improvement Act of 1970 (Title II of P.L. 91-224 - 4/3/70). (1) To assure that each Federal department and agency conducting or supporting public works activities which affect the environment shall implement the policies established under existing law; and (2) to authorize an Office of Environmental Quality, which, notwithstanding any other provision of law, shall provide the professional and administrative staff for the Council on Environmental Quality established by Public Law 91-190.

- Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500 - 10/18/72)(replacing the Act of 1956, as amended, by the Water Quality Act of 1965, the Clean Water Restoration Act of 1966 and the Water Quality Improvement Act of 1970). To restore and maintain the chemical, physical, and biological integrity of the Nation's waters. In order to achieve this objective it is hereby declared that, consistent with the provisions of this Act--(1) it is the national goal that the discharge of pollutants into the navigable waters be eliminated by 1985; (2) it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983; (3) it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited; (4) it is the national policy that Federal financial assistance be provided to construct publicly owned waste treatment works; (5) it is the national policy that areawide waste treatment management planning processes be developed and implemented to assure adequate control of sources of pollutants in each State; and (6) it is the national policy that a major research and demonstration effort be made to develop technology necessary to eliminate the discharge of pollutants into the navigable waters, waters of the contiguous zone, and the oceans.

- Federal Environmental Pesticide Control Act of 1972 (P.L. 92-516 - 10/21/72)(includes the Federal Insecticide, Fungicide and Rodenticide Act, so-called "FIFRA", 7 U.S.C. 135, et seq.) as amended by P.L. 94-51 and P.L. 94-140. The Act establishes a comprehensive regime to regulate, including banning, the manufacture, commercial sale and use of pesticides. The Administrator of EPA is charged to register, reregister, and classify pesticides, insure that pesticide containers are labeled according to regulations developed by the Administrator, and insure that pesticides classified as restricted be applied by a certified applicator or according to any other criteria deemed appropriate by the Administrator.

- Marine Mammal Protection Act of 1972 (P.L. 92-522 - 10/21/72). To protect marine mammals; to establish a Marine Mammal Commission; and for other purposes.

  The Act provides for the regulation of the taking of marine mammals so that certain species and population stocks will not diminish beyond the point at which they cease to be a significant functioning element in the ecosystem of which they are a part, and consistent with this major objective, they will not be permitted to diminish below their optimum sustainable population. Further measures are to be taken to replenish any species or population stock which has already diminished below that population. In particular, efforts are to be made to protect the rookeries, mating grounds, and areas of similar significance for each species of marine mammal from the adverse affect of man's actions. Negotiations are to be undertaken to encourage the development of international arrangements for research on, and conservation of, all marine mammals.

- Marine Protection, Research, and Sanctuaries Act of 1972 (P.L. 92-532 - 10/23/72). To regulate the transportation for dumping, and the dumping, of material into ocean waters, and for other purposes.

  It is the purpose of this Act to regulate (1) the transportation by any person of material from the United States and, in the case of United States vessels, aircraft, or agencies, the transportation of material from a location outside the United States, when in either case the transportation is for the purpose of dumping the material into ocean waters and (2) the dumping of material transported by any person from a location outside the United States if the dumping occurs in the territorial sea or the contiguous zone of the United States.

- Noise Control Act of 1972 (P.L. 92-574 - 10/27/72). To control the emission of noise detrimental to the human environment and for other purposes.

  The Act is designed to promote an environment for all Americans free from noise that jeopardizes their health or welfare. To that end, it is the purpose of the Act to establish a means for effective coordination of Federal research and activities in noise control, to authorize the establishment of Federal noise emission standards for products distributed in commerce, and to provide information to the public respecting the noise emission and noise reduction characteristics of such products.

- Coastal Zone Management Act of 1972 (P.L. 92-583 - 10/27/72). To establish a national policy and develop a national program for the management, beneficial use, protection, and development of the land and water resources of the Nation's coastal zones, and for other purposes.

  The purposes of the Act are: (1) To preserve, protect, develop, and where possible, to restore or enhance, the resources of the Nation's coastal zone for this and succeeding generations; (2) to encourage and assist the States to exercise effectively their responsibilities in the coastal zone through the development and implementation of management programs to achieve wise use of the land and water resources of the coastal zone giving full consideration to ecological, cultural, historic, and aesthetic values as well as the need for economic development; (3) for all Federal agencies engaged in programs affecting the coastal zone to cooperate and participate with State and local governments and regional agencies in effectuating the purposes of this title; and (4) to encourage the participation of the public, of Federal, State and local governments and of regional agencies in the development of coastal zone management programs. With respect to implementation of such management programs, it is the national policy to encourage cooperation among the various State and regional agencies including establishment of interstate and regional agreements, cooperative procedures, and joint action particularly regarding environmental problems.

- Endangered Species Act of 1973 (P.L. 93-205 - 12/28/73). To provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved; to provide a program for the conservation of such endangered species and threatened species; and to take such steps as may be appropriate to achieve the purposes of relevant treaties and conventions.

- Energy Supply and Environmental Coordination Act of 1974 (P.L. 93-319 - 6/22/74). (1) To provide for a means to assist in meeting the essential needs of the United States for fuels, in a manner which is consistent, to the fullest extent practicable, with existing national commitments to protect and improve the environment; and (2) to provide requirements for reports and respecting energy resources.

- Toxic Substances Control Act (P.L. 94-469 - 10/11/76). To regulate commerce and protect human health and the environment by requiring testing and necessary use restrictions on certain chemical substances, and for other purposes.

  It is the policy of the United States that (1) adequate data should be developed with respect to chemical substances and mixtures concerning their effect on health and the environment and that such data development should be the responsibility of those who manufacture and those who process such chemical substances and mixtures; (2) adequate authority should exist to regulate chemical substances and mixtures which present an unreasonable risk of injury to health or the environment, and to take action with respect to chemical substances and mixtures which are imminent hazards; and (3) authority over chemical substances and mixtures should be exercised in such a manner as not to impede unduly or create unnecessary economic barriers to technological innovation while fulfilling the primary purpose of this Act to assure that such innovation and commerce in such chemical substances and mixtures do not present an unreasonable risk of injury to health or the environment.

- Federal Land Policy and Management Act of 1976 (P.L. 94-579 - 10/21/76). To establish public land policy; establish guidelines for its administration; to provide for the management, protection, development and enhancement of the public lands; and for other purposes.

Provides an organic act for the Bureau of Land Management of the Department of the Interior and, among other things, directs that management of the public lands be on a multiple use and sustained yield basis, unless otherwise specified by law. Further, requires that the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archelogical values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use.

- Resource Conservation and Recovery Act of 1976 (P.L. 94-580 - 10/21/76). To amend the Solid Waste Disposal Act to provide technical assistance for the development of management plans and facilities for the recovery of energy and other resources from discarded materials and for the safe disposal of discarded materials and to regulate the management of hazardous waste.

  This Act authorizes State program and implementation grants to provide incentives for the recovery of resources from solid wastes, to control the disposal of hazardous wastes, and for other purposes. It provides for Federal regulation of hazardous wastes, the establishment of a grant program for State solid waste management planning, and the expansion of Federal solid waste research and development.

- National Forest Management Act of 1976 (P.L. 94-588 - 10/22/76). To amend the Forest and Rangeland Renewable Resources Planning Act of 1974, and for other purposes.

  The Act provides that in order to serve the national interest, the comprehensive assessment of present and anticipated uses, demand for, and supply of renewable resources from the Nation's public and private forests and rangelands, through analysis of environmental and economic impacts, coordination of multiple use and sustained yield opportunities as provided in the Multiple-Use Sustained-Yield Act of 1960, and public participation in the development of the program.

It also provides that recycled timber product materials are as much a part of our renewable forest resources as are the trees from which they originally came, and in order to extend our timber and timber fiber resources and reduce pressures for timber production from Federal lands, the Forest Service should expand its research in the use of recycled and waste timber product materials, develop techniques for the substitution of these secondary materials for primary materials, and promote and encourage the use of recycled timber product materials.

A partial list of health and safety legislation enacted in the past decade and a half and not previously described as environmental legislation, includes the following:

- Federal Hazardous Substances Labeling Act (P.L. 86-613 - 7/12/60). To regulate the interstate distribution and sale of packages of hazardous substances intended or suitable for household use.

- Service Contract Act of 1965 (P.L. 89-286 - 10/22/65). This Act provides, among other things, that every contract entered into by the United States or the District of Columbia in excess of $2,500, except as provided in section 7, whether negotiated or advertised, the principal purpose of which is to furnish services in the United States through the use of service employees shall contain a provision that no part of the services covered by this Act will be performed in buildings or surroundings or under working conditions, provided by or under the control or supervision of the contractor of any subcontractor, which are unsanitary or hazardous or dangerous to the health or safety of service employees engaged to furnish the services.

- National Traffic and Motor Vehicle Safety Act of 1966 (P.L. 89-563 - 9/9/66). To provide for a coordinate national safety program and establishment of safety standards for motor vehicles in interstate commerce to reduce accidents involving motor vehicles and to reduce the deaths and injuries occurring in such accidents.

The Act provides for the establishment of motor vehicle safety standards for motor vehicles and equipment in interstate commerce, necessary safety research and development, and expansion of the national driver register.

- Federal Metal and Nonmetallic Mine Safety Act (P.L. 89-577 - 9/16/66). To promote health and safety in metal and nonmetallic mineral industries, and for other purposes.

  The Act provides, among other things, that the Secretary of the Interior shall develop, and from time to time revise, after consultation with advisory committees, and promulgate health and safety standards for the purpose of the protection of life, the promotion of health and safety, and the prevention of accidents in mines which are subject to this Act.

- Natural Gas Pipeline Safety Act of 1968 (P.L. 90-481 - 8/12/68). To authorize the Secretary of Transportation to prescribe safety standards for the transportation of natural and other gas by pipeline, and for other purposes.

- Federal Coal Mine Health and Safety Act of 1969 (P.L. 91-173 - 12/30/69). To provide for the protection of the health and safety of persons working in the coal mining industry of the United States and for other purposes.

  (1) To establish interim mandatory health and safety standards and to direct the Secretary of Health, Education and Welfare and the Secretary of the Interior to develop and promulgate improved mandatory health or safety standards to protect the health and safety of the Nation's coal miner; (2) to require that such operator of a coal mine and every miner in such mine comply with such standards; (3) to cooperate with, and provide assistance to, the States in the development and enforcement of effective State coal mine health and safety programs; and (4) to improve and expand, in cooperation with the States and the coal mining industry, research and development and training programs aimed at preventing coal mine accidents and occupationally caused diseases in the industry.

- Federal Railroad Safety Act of 1970; Hazardous Materials Transportation Control Act of 1970 (P.L. 91-458 - 10/16/70). To provide for Federal railroad safety, hazardous materials control and for other purposes. To promote safety in all areas of railroad operations and to reduce railroad-related accidents, and to reduce deaths and injuries to persons and to reduce damage to property caused by accidents involving any carrier of hazardous materials.

- Occupational Safety and Health Act of 1970 (P.L. 91-596 - 12/29/70). To assure safe and healthful working conditions for working men and women; by authorizing enforcement of the standards developed under the Act; by assisting and encouraging the States in their efforts to assure safe and healthful working conditions; by providing for research, information, education, and training in the field of occupational safety and health; and for other purposes.

- Federal Boat Safety Act of 1971 (P.L. 92-75 - 8/10/71). To provide for a coordinated national boating safety program. To improve boating safety and to foster greater development, use, and enjoyment of all the waters of the United States by encouraging and assisting participation by the several States, the boating industry, and the boating public in development of more comprehensive boating safety programs; by authorizing the establishment of national construction and performance standards for boats and associated equipment; and by creating more flexible regulatory authority concerning the use of boats and equipment. It is further declared to be the policy of Congress to encourage greater and continuing uniformity of boating laws and regulations as among the several States and the Federal Government, a higher degree of reciprocity and comity among the several jurisdictions, and closer cooperation and assistance between the Federal Government and the several States in developing, administering, and enforcing Federal and State laws and regulations pertaining to boating safety.

- Safe Drinking Water Act (P.L. 93-523 - 12/16/74). To assure that water supply systems serving the public meet minimum national standards for protection of public health. To authorize the Environmental Protection Agency to establish Federal standards with respect to harmful contaminants, applicable to all public water systems; and to establish a joint Federal-State system for assuring compliance with these standards and for protecting underground sources of drinking water.

- Ports and Waterways Safety Act of 1972 (P.L. 92-340 - 7/10/72). To promote the safety of ports, harbors, waterfront areas, and navigable waters of the United States. To, among other things, regulate vessels carrying oil and hazardous substances for safety and environmental protection purposes.

- Hazardous Materials Transportation Act (P.L. 93-633 - 1/3/75). To regulate commerce by improving the protections afforded the public against risks connected with the transportation of hazardous materials, and for other purposes. To improve the regulatory and enforcement authority of the Secretary of Transportation to protect the Nation adequately against the risks to life and property which are inherent in the transportation of hazardous materials in commerce.

- Consumer Products Safety Act (P.L. 92-573 - 10/27/72). To protect consumers against unreasonable risk of injury from hazardous products.

- National Mobile Home Construction and Safety Standards Act of 1974 (P.L. 93-383 - Title VI). To reduce the number of personal injuries and deaths and the amount of insurance costs and property damage resulting from mobile home accidents and to improve the quality and durability of mobile homes.

- Motor Vehicle and Schoolbus Safety Amendments of 1974 (P.L. 93-492). To require, among other things, that schoolbus safety standards be prescribed.

- Child Protection and Toy Safety Act of 1969 (P.L. 91-113). To amend the Federal Hazardous Substance Act to protect children from toys and other articles intended for use by children which are hazardous due to the presence of electrical, mechanical, or thermal hazards.

- Flammable Fabrics Act Amendments (P.L. 90-189). To amend the Flammable Fabrics Act to increase the protection afforded consumers against injurious flammable fabrics.

This burgeoning of federal regulatory authority has not, of course, gone unnoticed. But there is far less than a full appreciation of the extent to which it--in addition to other elements of the growth of "big government"--has contributed to the sense that power in the American federal system has moved away from the individual and the local environment to some rather uncontrollable central authority, viewed with contempt by the alienated as, simply, "Washington."

This is by no means to argue that the centripetal forces of modern industrial development which account for burgeoning federal regulation can or should be reversed. It is to suggest that the way in which the American system of environmental, health and safety regulation is developed must affect not only environment, health and safety, and not only the pattern of economic development--but it must also, inescapably and fundamentally, affect the relationships between individuals and their government, and ultimately the basic attitudes with which individuals view their governmental system generally.

The Limits of "Corporate Responsibility"

Among those who most vociferously lament the growth of "big government," a majority wishes, in one way or another, to return to (or to leave with) the private sector many of the responsibilities recently determined to be public and to require governmental action. This direction of argument may be applied to both "big government" viewed in terms of expenditures and employment, and "big government" viewed in terms of emergent regulatory responsibilities.

There are two associated lines of argument as to the directions for increased "corporate responsibility." One tends to rely on the superior technological and managerial capability--the improved efficiency and responsiveness--associated with the dynamics of private action in a competitive, profit-motivated market environment. The second tends to rely on hopes for the improved moral sensitivity and responsiveness of the private sector in addressing what would otherwise be shortcomings of the competitive marketplace--through direct charitable contributions and/or through ethically determined policies above and beyond the dictates of competition. (Note: This form of "corporate responsibility" goes beyond "enlightened self-interest"--which is, ultimately, a response to an investment calculus and a conception of the dictates of the market, broadly conceived. It should be noted further that "enlightened self-interest" is not fixed; it is evolving--and there is some reason to believe that both breadth of concern and length of time-perspective are expanding for many corporations. Nonetheless, self-interested corporate behavior continues to fall well short of what many view as appropriate from a social perspective.)

It is necessary to consider the limits of such arguments, before turning to the analysis of environmental, health and safety regulation which forms the body of this paper. For that analysis, although critical of the current regulatory system, and particularly sympathetic to the arguments for market efficiency, is not oriented toward the radical reform which these arguments might suggest. If these arguments were to be accepted without serious limitation, that analysis would clearly be of less importance and of less relevance. But there are obvious limits to the applicability of arguments for increased corporate responsibility.

There is no plausible reason whatever to expect that the public will seek a significant reduction in the percent of GNP allocated through governmental expenditure.

It is analytically conceivable that private charitable contributions, as supplements to public expenditures, might relieve some of the pressures on the public financing of the general welfare. But, as a matter of practical fact, the record of private corporate charitable giving does not give reason for significant positive expectations. Since 1935 when the "five percent amendment" of the Internal Revenue Code allowed private corporations to claim deductions on up to 5% of pre-tax income, corporate giving as a whole has never come close to the limit. Before World War II, contributions averaged less than .5% of net pre-tax corporate income; and although the average increased to a high of 1.24% in 1969, it has since declined steadily.

It is conceivable that the private sector could and would, on a for-profit basis, assume greater responsibility for the general welfare by applying its strengths to the performance of a larger share of publicly-financed activities. There are significant limits to this potential, however. American government already is highly reliant upon the private sector for the provision of publicly-financed goods and services--to a greater extent, perhaps, than is generally appreciated. While all government expends a total of 32.5% of GNP, 22.6% of GNP is in direct government purchases of goods and services. A study by the Office of the Assistant Secretary for Policy has concluded that the principal opportunities for increased "privatization" lie in portions of the recently fast-expanding area of municipal and social services. An extensive analysis of these opportunities--and of currently associated regulatory obstacles--is at Appendix D. (It should be noted, of course, that increased "privatization" requires not only the removal of certain regulatory obstacles, but the imposition, in some cases, of new regulations to assure that publicly-determined performance standards are met.)

If "privatization" were to have major potential, it might be argued that a set of "big government" problems--particularly those concerning inefficiency, remoteness and unresponsiveness--would be reduced. And an extension of this argument might then be that the social tolerance for the centripetal tendencies now associated with environmental, health and safety regulation would, accordingly, be increased. But while analysis suggests that there are some significant opportunities for increased "privatization", the scale of these opportunities does not seem sufficient to constitute the major potential necessary to support this line of argument.

There remains then the question as to the extent of likely increases in "corporate responsibility" defined in terms of improved corporate social behavior based on improved moral sensitivity--above and beyond the dictates of law and market pressures. Hope for significant increases here must be limited by several considerations.

First, there is need to consider the historical record. The American private sector has an unrivaled record for producing a rising standard of living for a major population--within a framework which has favored both profit-oriented private competition and increasing legal protection of individual rights and collectively defined social values. That said--and it is in no respect to be diminished by the qualification which follows--it is also the case that the private sector has tended to lag in the voluntary service of social values. It has, in general, "voluntarily" responded to the pressures of workers and of communities when economic interest has dictated; and it has, in general, responded to the evolving dictates of law. But, in general, private corporations have not been lead institutions in the evolution or service of social values.

It is of course true that the percentage of employees covered by some form of health insurance, for example, has consistently and dramatically increased; or that similarly, the coverage, number and funding of private pension plans have significantly increased. But such evolution has been primarily in response to the power of labor unions (and secondarily, in response to changes in workers' preferences as to the form in which to take rising compensation). There is now evident a greater employer interest in the "quality of the work environment"--but largely in response to consideration of the economic effects of worker alienation, turnover and productivity; not as an independent matter of humane or aesthetic concern. In the areas of equal employment opportunity and environmental protection, the socially desired corporate response has generally required law and regulation to produce it. The record of wholly voluntary pursuit of higher social values is, in short, rather thin.

A second consideration is one of economic theory. The American profit-and market-oriented system assumes that, under conditions of competition, there will be pressures to minimize costs required to produce a given product for which there is demand. This is, on the whole, a favorable characteristic of the system. And the fact that history does not reveal the voluntary pursuit of higher social values by corporations, in circumstances which might put them at a competitive disadvantage, should not be surprising or disturbing. Indeed, to assume that corporations in general would go beyond enlightened self-interest would be to deny the basic psychological premise of the theory on which the American system is based.

A third, related consideration is one of philosophy. If corporations were to be expected to go beyond what enlightened self-interest would otherwise dictate--but to do so without putting themselves at a competitive disadvantage with respect to each other--there would have to be a code applied equitably to all competitors. This might be done through some form of guild system--as is theoretically the case in the self-regulation of law and medicine. But this then raises two obvious points of difficulty: It is difficult to reconcile the legitimizing of this collusive behavior with the principles of competition

which, as noted, underlie the American system. And even if this were not a problem, it would be difficult to justify the delegation of the determination of "social interest" or "public interest" to a guild which would have no special claim to relevant training or to peculiarly inaccessible expertise or to democratic representativeness. Indeed, it would seem impossible to make the case, for the American system, that any such code should be developed and applied through a mechanism other than one which derives its authority from a democratically representative system--i.e., through a system of democratically determined law and regulation.

In sum, it seems reasonable to assume: that neither charity nor "privatization" is likely to reduce to any significant degree the size of government as conventionally measured, nor the prevalent concern with "bigness"; and that reliance on private corporations' moral sensitivity, above and beyond law and enlightened self-interest, would be inconsistent with principles of competition (and, in some cases, of equity).

Hence, the perspective adopted for the analysis which follows is one which, on the one hand, presumes a need for continuing concern with the social and political problems of alienation associated, in part, with the modern shift in the balance of governmental power away from the private sector and toward "Washington." While on the other hand, it presumes that, notwithstanding the values of efficiency and responsiveness associated with the flexibility and competitiveness of the private sector, the equitable pursuit of several classes of social objectives requires governmental regulation.

The pursuit of regulatory reasonableness, then, cannot be one which would seek some radical shift away from the current system. Rather, it must seek to assure balanced consideration of interests in national environmental, health and safety objectives; interests in the avoidance of excessive centralization; and interests in economic efficiency and flexibility.

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The second part (B) of this paper, which follows, analyzes first the current legislative framework--and the extent to which it permits such balancing. It then reviews available empirical evidence as to the costs and benefits associated with regulation in this framework. The third part (C) discusses approaches which might improve the process of balancing.

B. REGULATORY INTERVENTION: BALANCING COSTS AND BENEFITS NOW

Major Characteristics of the Current Legislative Framework

Three statutes--the Clean Air Act Amendments of 1970, the Federal Water Pollution Control Act Amendments of 1972, and the Occupational Safety and Health Act of 1970--are by far the most significant of the host of environmental health and safety measures adopted during the past two decades. They resulted from a heightened national concern for environmental issues and an impatience with the pace and efficacy of state regulation of environment, health and safety. They are a testament to Congressional confidence in the effectiveness of federal regulation as a means to cure national ills. Enacted in the period between our "conquest" of the moon in 1969 and the Arab oil embargo of 1973, these statutes are founded upon vast technological and economic optimism.

These three statutes must, therefore, be at the center of any responsible, critical analysis of our current approach to environmental health and safety goals. This section reviews the major provisions of these statutes and the implementation of these provisions in order to assess the extent to which they permit rational, effective regulation. The assessment suggests that these statutes contain rigidities which preclude full and appropriate consideration of costs of implementation and that, therefore, they may command unreasonable outcomes.

While many critics of environmental, health and safety regulations take as their targets the "regulators" themselves--the OSHA and EPA "bureaucrats"--this critical focus is, in considerable measure, misdirected. To an extent seldom publicly understood, regulatory unreasonableness is a product of legislative mandate.*/ It is

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*/ Of course, the degree to which the regulators are a fair target of criticism can depend on the scope of Congress' delegation of regulatory discretion. As will be shown in the ensuing analysis, the Congress, in the Clean Air and Clean Water Acts, legislated with considerable specificity and, in so doing, limited somewhat the scope of regulatory discretion. In the case of the Occupational Safety and Health Act, the legislative delegation, and hence the discretion of its executors, is quite broad.

regulators and not legislators who stand accused of unreasoning and unwarranted interference with the commerce of the Nation, yet, the former are usually carrying out tasks that are legally compelled by Congress--or in some instances, by federal judges construing Congressional intent. In fact, the regulators have, with considerable courage and creativity, begun to exercise administrative discretion, in the face of an apparently contradictory statutory mandate, in order to reach reasonable regulatory results. Their actions in so doing have become subject to court challenge by environmental plaintiffs seeking to guard the letter of the law.

The enthusiastic assault by Congress on the Nation's substantial and too-long neglected environmental, health and safety problems is not criticized here for its intentions. This paper does, however, seek to raise question with some of the results of this assault. The complexity of the issues addressed by environmental health and safety legislation, has only made itself fully manifest after the legislative process has been completed. For instance, individual statutes such as the Clean Air and Clean Water Acts were passed as ends in themselves without a full understanding of their potential interrelationships. Yet, environmental legislation, once enacted, is extremely difficult to amend, since amendment is too often perceived as a retreat from the goals of the assault as opposed to a tactical adjustment.

The following discussion does not purport to contain a complete or comprehensive discussion of the requirements of the three statutes or of the problems encountered in their implementation. Rather it will outline their principal goals and schemes for attaining these goals to determine the extent to which they allow reasonable consideration of the costs--specific and general--of their implementation.

The Clean Air Act Amendments of 1970

- Summary of Provisions

A stated, principal purpose of the Clean Air Act Amendments of 1970 is "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." To this end, the Act requires the Environmental Protection Agency (EPA) to establish nationally uniform ambient air quality

standards for major air pollutants emitted from "numerous or diverse mobile or stationary sources." To promote the public health, EPA is required to promulgate so-called "primary" standards which allow an "adequate margin of safety." To promote public welfare--this term has been interpreted to require the limiting of pollutant emissions which may harm soil, water, crops or aesthetics--EPA is required to issue "secondary" standards. The Act seems to assume that it is possible to define a point, below which pollution is not harmful. However, scientific evidence is ambiguous and often does not provide such benchmarks.

These national standards are to be based upon the best available scientific evidence regarding the effects of various pollutants on public health and welfare and not upon any consideration of the costs or technological feasibility of the attainment of such standards. This fact was recently confirmed by the U.S. Supreme Court*/ which stated that Congress specifically contemplated that some existing sources of pollution would have to be shut down to meet the requirements of these standards as applied.

The Act requires states to develop and enforce implementation plans for the achievement of these standards. While this scheme gives states a substantial and important role in the implementation of the Clean Air Act, the Act requires EPA to substitute its judgment whenever a state's implementation plan does not meet the requirements of the Act. Thus, a state which might act upon a concern for the technological or economic feasibility of implementation of a national standard in the context of a state implementation plan may be overruled by the EPA. Conversely, EPA is without authority to reject a state's plan on the grounds of economic or technological infeasibility.

The Clean Air Act also requires EPA to establish nationally applicable standards to govern emissions of "hazardous" pollutants--defined as those which "may cause, or contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness." These hazardous pollutant standards must be set at a level which EPA believes will provide an "ample margin of safety" to protect the public health.

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*/ Union Electric Co. v. EPA. 96 Sup. Ct. 2518 (1976).

With regard to these standards, the Act makes no specific allowance for consideration of economic or technological feasibility--a fact that has caused, as will be discussed below, significant difficulty in the formulation of such standards.

EPA is also required to establish nationally applicable performance standards for new sources of air pollution. In contrast to hazardous pollutant standards and to primary and secondary standards, these so-called "new source performance standards" specifically require consideration of cost and availability of technology. Both hazardous pollutant and new source standards, in contrast to primary and secondary standards, directly establish federal limits on emissions from point sources, not subject to the exercise of state discretion within state implementation plans.

Finally, the Clean Air Act requires EPA to set emission standards for new automobiles necessary to achieve specified reduction in automotive emissions. These specified reductions are stated in relatively rigid terms--a 90 percent reduction on a five to six year timetable--without regard to costs or technological feasibility. However, the Act gave EPA the authority to set interim standards based upon best available technology. Standards originally set with 1975 and 1976 deadlines have been extended to 1977 and 1978, respectively. However, it is currently apparent that they will not be achieved by the 1978 model year and thus action in the new Congress to define reasonable automotive emission standards is imperative.

Much of the public debate regarding the Clean Air Act has focused upon means and timetable for reducing automotive emissions. Less public scrutiny has been given the other provisions of the Clean Air Act, and, therefore, the highly limited discussion in this paper is directed to the implementation of the non-automotive sections of the Act. As will be shown below, these sections have substantial implications for U.S. energy supplies and for the pattern and scope of future economic development. Since energy is a "cost" of extreme national concern, it is appropriate first to address the energy consequences of our clean air aspirations.

• Energy and Clean Air

Prior to 1973, a significant portion of the Nation's air pollution clean up efforts had been predicated upon the availability of ample quantities of low-sulfur content oil for use in electrical generating facilities. The 1973 Arab oil embargo led to a re-evaluation of the "costs" of our clean air objectives in face of energy scarcity. After a review of energy requirements in light of the Clean Air Act, the Congress in 1974 enacted the Energy Supply and Environmental Coordination Act. The purpose of this enactment is to encourage burning of coal in place of oil and natural gas to generate electricity. To facilitate coal burning, EPA was given authority to suspend, temporarily, emission limitations for specific facilities, providing primary, health-related standards would not be violated.

While this limited legislative redress is important, our national energy objectives and clean air aspirations remain importantly--and not always felicitously--intertwined.*/

One important example of this interdependency is the controversy over the use of "scrubbers" versus "intermittent" and "dispersive" control systems to abate sulfate emissions from industrial and especially electric generating plants. Intermittent controls involve curtailment of plant operations during periods where atmospheric conditions will cause violation of air quality standards. Dispersive controls use tall smoke stacks to disperse or dilute emissions in order to comply with air quality standards. Scrubbers or scrubbing systems operate continuously to remove sulfur dioxide emissions from the burning of fossil fuels. Not only are scrubbers costly in contrast to intermittent or dispersive controls, they involve an energy cost which can total three to five percent of the production of a generating plant. In addition, they create a sludge by-product which is difficult of disposal.

Thus, while it is strong national policy to reduce dependency on imported low-sulfur oil by using

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*/ For a stimulating discussion of this interdependency see the essay by Marc J. Roberts and Richard B. Stewart in Setting National Priorities, Henry Owen and Charles L. Schultze, Editors, The Brookings Institution, at 440-447 (1976).

coal in electrical generating facilities, use of coal increases the need to abate sulfur dioxide emissions to meet national air quality standards--and consequently the need for scrubbers with their attendant costs and energy penalties. An even more substantial national cost may be incurred because of insistence on scrubber technology as best available control technology for new source performance standards. Since it is predictable that, in the next decade, new technologies will emerge that will obviate the need for scrubbers, utilities may be deferring needed expansion of capacity in order to avoid installation of scrubbers, pending development of preferable technology.

The controversial insistence on scrubbers by EPA results from Congressional mandate, for the Clean Air Act apparently does not allow use of intermittent or dispersive control techniques in lieu of scrubbers. The Act speaks in terms of emission limitations and this fact has been construed to proscribe primary reliance upon control systems--such as intermittent and dispersive ones--which do not limit emissions in meeting primary and secondary air quality standards. NRDC v. EPA, 479 F.2d 390 (5th Cir. 1974).

- Nondegradation

The federal courts have held that, since a primary purpose of the Clean Air Act is to protect and enhance the Nation's air quality, no state in its implementation plan could permit "significant deterioration" of air quality in areas where air was already cleaner than required by national air quality standards.*/ Literally construed, the concept of nondeterioration would require no growth or industrialization in "clean air" areas and would raise the specter of national land-use planning.

The courts directed EPA to develop regulations to implement the no significant deterioration concept. EPA's final regulations--issued after long public debate--separate clean air areas into three classifications:

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*/ Sierra Club v. Ruckelshaus, 344 F. Supp. 253 (D.DC. 1972), aff'd per curiam 4 ERC 1815, aff'd by an equally divided Court 412 U.S. 541 (1973).

-- Class I, where air quality is protected at essentially existing levels,

-- Class II, where moderate growth would be permitted, and

-- Class III, where major industrialization and growth would be allowed to a point at which air pollution reaches uniform national standards.

The regulations further require that, in all three area classifications, major new industrial facilities must control emissions at a level of control equivalent to application of the best available control technology, regardless of cost, (new source performance standards generally require best available control technology taking account of costs).

EPA initially designated all areas as Class II and gave authority to Governors of each state to submit proposals to EPA to redesignate any such area as Class I or III. Proposed redesignations must be based on the record of a public hearing held near the area proposed to be redesignated and must include consideration of anticipated growth, social, environmental and economic effects of the proposed redesignation, and any impact of the proposed redesignation on regional or national interests. EPA must approve any proposed redesignation unless the Administrator finds such redesignation to be arbitrary and capricious.

By this means, EPA has avoided direct federal land-use planning on the basis of air quality considerations. Nevertheless, the no significant deterioration concept requires states to impose a land-use regime based on an air quality standard, a process which does not allow adequate accommodation of the complex relationships between air quality and other factors which must affect land use. Debate continues to rage regarding the impact of EPA's regulations on new industrial development in "clean air areas." Also, doubts persist whether present air quality can even be measured with sufficient precision to apply the prescribed standards.

American businessmen and especially electric power companies remain fearful of the implications of the nondeterioration concept. It can, they believe, lead to nationwide land-use planning. On the other hand,

environmental advocates are not content with the EPA's approach to nondeterioration. During consideration of the Clean Air Act Amendments in the last Congress, statutory nondeterioration provisions were proposed, but not enacted. It can be argued that stringent nondeterioration measures are prerequisites for effective air pollution abatement, since pollutants emitted to the ambient atmosphere can have consequences for wide areas extending beyond individual pollution control regions. Resolution of the nondeterioration issue by additional legislation, if not responsibly drawn, can have dramatic consequences for the Nation's economy.

- Hazardous Pollutants

In face of a growing belief that emissions from petrochemical facilities may contribute to the incidence of human cancer, the as of yet, little-used hazardous pollutant section of the Clean Air Act has startling implications.

As already noted, the Clean Air Act (Section 112) requires EPA to establish nationally applicable emission standards for "hazardous pollutants" applicable to new and existing sources--at levels sufficient to provide an "ample margin of safety" to protect the public health from such hazardous pollutants. Similar language requiring that primary national air quality standards provide an adequate margin of safety to protect the public health has been construed to require that the standard be set without regard to economic or technological feasibility.

In the case of so-called "non-threshold pollutants" --those which may create some degree of health risk at any ambient level above zero--EPA faces a quandary in establishing an "ample margin of safety" without demanding a halt in production. EPA most recently addressed this issue in establishing a hazardous pollutant standard for ambient emissions of vinyl chloride--a cancer causing petrochemical gas which is the basic ingredient for a significant portion of the plastics manufactured in this country. Since a zero emission limit is technologically infeasible and, therefore, would cause very substantial economic dislocation, EPA adopted an interpretation of the Clean Air Act which would avoid such dislocation. EPA determined, in the case of vinyl chloride, since a

zero emission would result in widespread industry closure, the costs of which would be grossly disproportionate to the benefits, that imposition of a requirement of best available control technology was the soundest means to regulate. Thus, EPA undertook a very gross cost/benefit analysis--even though the Act appears to preclude such considerations with regard to hazardous pollutants.

EPA's vinyl chloride standard has recently been challenged in federal court, on the grounds that EPA exceeded its authority in taking such economic considerations into account and that, absent scientific evidence of a safe level of emissions, vinyl chloride emissions must cease. The outcome of this lawsuit has dramatic implications for the future of the petrochemical industry--if, as is entirely possible, other basic petrochemicals are demonstrated to have serious human health effects.

- Summary

The Clean Air Act imposes an ambitious and in some measure inflexible scheme for the clean-up of the Nation's ambient atmosphere. Its provisions are designed to "force" technology--a not unworthy legislative objective--to enable this clean-up. The changes in the Nation's energy and economic outlook since its enactment in 1970 continue to compel close scrutiny of the feasibility and consequence of strict adherence to the Clean Air Act's statutory mandate. Creative and balanced administration of the Act by EPA, including the nondeterioration requirement and the hazardous pollutant section, has avoided gross near-term economic penalties disproportionate to the perceivable near-term benefit of cleaner air. Nevertheless, the statute's literal, rigid requirements--always subject to court mandate that they be fully enforced--can have most serious consequences for the Nation's energy and economic goals.

The Federal Water Pollution Control Act Amendments of 1972

- Summary of Provisions

In adopting a national, regulatory approach to achieve clean water, Congress, in 1972, chose means which differ radically from those contained in the Clean Air Act to achieve clean air. Under the Clean Air Act, nationally uniform air quality standards are prescribed. Individual sources of pollution are assigned emission limits by state authorities under state implementation plans designed to achieve the national air quality standards. Under the Water Pollution Control Act, water quality is rejected as a primary benchmark for regulation. Instead, each point source of pollutant discharge (effluent) is required to meet nationally uniform, technologically-based, effluent limits regardless of water quality considerations. Water quality becomes relevant only where it is adjudged necessary to apply effluent limitations more stringent than the nationally prescribed standards in order to meet state water quality requirements.

Water pollution control legislation prior to 1972 more closely modelled the Clean Air Act, and had water quality as its primary focus. Difficulties of enforcement by state authorities and controversy regarding proper gauges of water quality led, at best, to imperfect progress toward cleaner water. The 1972 Amendments are a testament to frustration with the state and water quality-based approach. The result is a statute which inadequately accounts for costs and benefits of water pollution control as applied to individual plants and derogates, in undesirable measure, state-level discretion to tailor pollution abatement plans to local circumstances.

While its means are "blind" to water quality variables, the Act's ends are of course stated in terms of water quality. To the end of restoring and maintaining "the chemical, physical, and biological integrity of the Nation's waters," the Water Pollution Control Act declares a national goal of eliminating the discharge of pollutants into the Nation's waters by 1985. It sets an "interim goal" of achieving, by 1983, water quality which provides for "the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water."

The Act makes it unlawful to discharge any pollutant into the Nation's waters except in compliance with its terms and pursuant to a permit specifying the rate and amount of such effluent discharge. Each pollutant source must, therefore, obtain a permit from EPA or from state authorities exercising delegated authority from EPA. The terms of such permit are required to conform with limitations and guidelines established nationally by EPA for all point sources of a given "class or category."

The federally-established guidelines and limitations must be designed to compel achievement of technologically-based standards--"best practicable control technology currently available" (BPT) by July 1, 1977 and a more stringent standard, "best available technology economically achievable" (BAT) by July 1, 1983.

The Act applies to municipal sewage treatment plants*/ as well as to industrial point sources and industrial sources are given the option of "pretreating" their wastes and routing them through a municipal facility, where feasible or desirable.

New sources of pollutant discharge must meet standards of performance based upon "the greatest degree of effluent reduction" which EPA determines to be achievable through application of "the best available demonstrated control technology, processes, operating methods . . . including, where practicable, a standard permitting no discharge of pollutants." The Act directs EPA, in setting such standards, to take account of the cost, non-water quality environmental impact, and energy requirements involved.

The Act also requires regulation of "toxic" effluent discharge by effluent standards or prohibitions to provide a level of control that allows an "ample margin of safety" taking account of the toxicity, persistence, and degradability of the pollutant and its affect on organisms living in the receiving waters.

The foregoing description of the principal features of the Water Pollution Control Act, perforce, omits a great deal. A full description of this complex

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*/ Municipal treatment facilities are governed not by BPT and BAT but by analagous standards--secondary treatment by 1977 and more stringent controls by 1983.

and detailed Act is beyond the scope of this paper. Each of the requirements described above carries with it a timetable for accomplishment, most of which have proven grossly inadequate. The Act's requirements with regard to thermal pollution--immensely important to the nuclear power industry--are omitted. The following discussion of some of the costs and difficulties encountered in the Act's implementation is similarly limited and is designed to be suggestive rather than comprehensive.

- Inflexibility of the Permit System

As already noted, the Act requires each industrial point source of pollutant discharge to secure a permit from EPA or from state officials exercising delegated authority from EPA. This permit system contains substantial inflexibilities which place in question the reasonableness of the Act's regulatory scheme.

These permits must require enforcement of certain technological controls--BPT by 1977 and BAT by 1983--regardless of the quality of the waters into which the facility discharges. Water quality only becomes relevant if water quality considerations dictate controls more stringent than those required as a statutory minimum. Thus, in the case of a given point source, the permitting authorities are not allowed to relate the costs of pollution reduction to water quality benefits. As noted in the beginning of this section, this particular inflexibility is fundamental to the regulatory scheme of the Act.

Additional inflexibility, however, has been encountered in the definition and application of BPT and BAT standards to individual point sources. In defining BPT, EPA is charged to take into account:

> ". . . the total cost of application of technology in relation to the effluent reduction benefits to be achieved from such application, . . . the age of equipment and facilities involved, the process employed, the engineering aspects of the application of various types of control techniques, process changes, non-water quality environmental impact (including energy requirements), and such other factors as [EPA] deems appropriate."

However, once BPT has been defined, it must be applied to "classes or categories of dischargers." Thus, despite the specificity of the enumerated factors, the Act does not appear to allow their application to individual plants on a case-by-case basis. Consequently, EPA has faced a Herculean task of developing guidelines which, on the one hand, apply to a fairly defined class or category of plants, and on the other, equitably accounting for relevant diversity among plants within a given class or category. EPA's solution has been to analyze various industries in light of the relevant statutory factors, form subcategories based upon production processes employed and to develop single number pollutant parameters for those subcategories. For instance, BPT for a given subcategory of pulp mills might be stated in terms of 20 pounds of biochemical oxygen demand (BOD) per ton of pulp produced.

Not surprisingly, the guideline development process has lagged far behind statutory deadlines and has been subject to frequent and extensive court challenge. The Supreme Court currently has pending before it the issue of whether EPA must specify a "range," rather than a single number as a definition of BPT. If the Supreme Court agrees with the contention that BPT should be stated as a range, e.g., 20 to 30 pounds of BOD per ton of production, it would allow permitting authorities to tailor BPT requirements to individual point sources taking more precise account of the statutory factors, than is currently possible under the single number approach.

Nevertheless, one thing remains clear--the statute's reference to "effluent reduction benefits" refers only to the reduction in the amount of effluent and not the effect of the effluent on receiving water quality.

- Rigidity with Regard to Water Quality - Puget Sound

The inflexibility of the permit system has been highlighted by the case of Pacific northwest pulp and paper mills which discharge into Puget Sound--a deep, fast moving body of water with great "assimilative" capacity. Under the terms of the Act, these facilities must meet the same technological standards as pulp and paper mills located on small, inland streams. One consequence is that these mills may have to reduce, to an extent that is arguably unreasonable, effluent discharges into that portion of their immediate environment--Puget Sound--which has the greatest capacity

to assimilate them. Instead, they will have to treat their wastes to high degrees, creating sludge which will have to be disposed of by landfill or incineration --consuming substantial amounts of increasingly scarce electrical energy and possibly contributing to substantial Pacific northwest air pollution problems. Similar circumstances are faced by certain public treatment plants which discharge into the ocean for the Act requires that they apply the full requirements of secondary treatment.

• Cost Rigidities - the Mahoning Decision

The insensitivity of the Act to cost considerations is aptly demonstrated by last year's Mahoning decision of EPA. Very early in the formulation of the 1977 BPT standards for the iron and steel industry, which were being set based upon the best practical control technology for the entire industry in the United States, it became apparent that there was a problem in the Mahoning Valley of Ohio. Many of the aging, marginal steel plants in the country were grouped there. Little pollution control equipment had been installed. The region is substantially dependent upon the 25,000 or more jobs directly and indirectly involved in those steel plants. It became clear that, if the iron and steel BPT requirements were applied according to the Act, the plants would close, causing massive regional unemployment and economic dislocation.

EPA's solution was to subcategorize the iron and steel plants in the Mahoning Valley from the rest of the plants in the country and to set for them a BPT level significantly less stringent than that applied generally.

Both the Sierra Club and the State of Pennsylvania (which is "downstream" from the Mahoning Valley) have challenged the Mahoning decision in court. The Sierra Club suit alleges that EPA's failure to require Mahoning plants to meet BPT requirements is a violation of its duties under the Act, particularly the requirement that effluent limitations be applied to all point sources in an appropriate category and that such limitations be as uniform as possible. It alleges that EPA is not empowered to distinguish the Mahoning plants from other iron and steel plants on economic grounds. The letter of the law supports the plaintiffs. Considerations of regulatory reasonableness are on the side of EPA, the defendant.

● Regulation of Toxic Substances

Though the Act requires regulation of discharge of toxic substances so as to provide an "ample margin of safety," only nine such substances have been listed and regulated under the toxic regulation section of the Act (Section 307(a)). The problems faced in the case of toxic substances under the Water Pollution Act are similar to those faced under the counterpart section of the Clean Air Act. Scientific uncertainty abounds. Regulation once undertaken cannot, on the face of the statute, account for technological or economic feasibility.

Environmental litigants, the EPA, and certain industrial intervenors, recently settled a legal action which should compel regulation of numerous substances under Section 307(a).*/ As a condition of settlement, EPA agreed to regulate 65 substances under the general limitations and guidelines sections of the Act, which, as noted above, allow consideration of costs and technological feasibility. This is a vast undertaking which may add considerable stringency and complexity to the already overburdened regulatory scheme. On the other hand, it avoids the potentially drastic inflexibility of the toxic pollutant section of the Act.

● Non-Point Source Discharges

A most significant source of water pollution, so-called "non-point source discharges," such as rain runoff from agricultural lands, is also subject to control under the Act. However, the federal mandate with regard to non-point source discharges is less well defined than is the case with point source discharges. A complicated scheme is created whereby states and local agencies are to establish comprehensive plans to control non-point source pollution and submit such plans to EPA for approval. However, based on current technology, control of non-point source pollution presents intractable problems. Little progress has been made toward non-point source control. In assessing the costs and benefits of our national commitment to extensive point source controls, one must keep in mind that clean water goals will not be attained if non-point source pollution cannot be controlled. This feature of the regulatory scheme is brought starkly into focus in assessing the overall benefits of moving from BPT to BAT for point source discharges, before a solution is found to the massive problem of non-point source discharges.

- Diminishing Returns?

A number of critics of the approach contained in the Act to abate water pollution, including a National Commission chaired by Vice President Rockefeller, have pointed out that the zero discharge goal is infeasible of attainment. Question has also been raised regarding the cost/benefit efficacy of reduction in basic pollutant parameters such as biochemical oxygen demand below the level required by BPT. The costs to achieve BAT, employing in most cases "process changes" as opposed to "end of pipe" treatment contemplated by BPT, may not be justified. As is usually the case, the last increments of pollution reduction--say from 85 percent abatement to a level approaching 100 percent, are progressively more costly and the total cost of the last 15 percent is much greater than the cost of the first 85 percent. Focus instead, it is argued, should be placed on reduction of toxic effluent. All agree that the original statutory timetable will not be met--municipalities have lagged behind industry in progressing toward the 1977 goal and have slowed accomplishment of BPT by those industrial firms planning to pretreat wastes for processing and discharge through municipal facilities. Toxic controls have proved infeasible under Section 307(a). The appropriate means to define and apply the 1977 standard of BPT to individual point sources is an issue before the Supreme Court. Non-point source discharges remain an essentially uncontrolled and major source of pollution.

The Occupational Safety and Health Act of 1970

- Summary of Provisions

The Occupational Safety and Health Act of 1970 establishes a comprehensive federal regulatory scheme to promulgate and enforce standards of occupational safety and health, which affect, with few exceptions, all employers engaged in a business having an effect on interstate commerce. Farmers with ten or fewer employees are exempted from the Act.

The Act's stated goal is, "to assure so far as possible every working man and woman in the Nation safe and healthful working conditions and to preserve our human resources." To accomplish this goal, the Act requires employers to:

(1) furnish to their employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to their employees, and

(2) comply with the occupational safety and health standards promulgated under the Act.

Each employee is charged to "comply with occupational safety and health standards and all rules, regulations, and orders issued pursuant to [the] Act which are applicable to his own actions and conduct." As will be discussed below, the Act places significantly different obligations on employers and employees in that the Act lacks any penalty or enforcement mechanism with regard to employees' obligations.

The Act is administered primarily by the Assistant Secretary of Labor for Occupational Safety and Health, who is the Administrator of the Occupational Safety and Health Administration (OSHA). In addition, the Act created within the Department of Health, Education and Welfare a National Institute for Occupational Safety and Health (NIOSH). NIOSH conducts research and develops criteria for occupational safety and health standards.

The Act charged OSHA with promulgating, as binding federal standards under the Act, as soon as practicable, during a two-year period from the effective date of the Act, certain pre-existing voluntary standards--so-called "national consensus standards." In addition, OSHA was directed to issue, during this period, as an OSHA standard, any "established federal standard." Further, OSHA was authorized on a continuing basis to promulgate any occupational safety or health standard upon determination that such a standard was necessary to serve the objectives of the Act.

Under its standard setting authority, OSHA, in cooperation with NIOSH, must regulate workplace exposure to "toxic materials or harmful physical agents." The Act provides that NIOSH must, on receipt of a request by an employer or authorized representative of employees, determine whether any substance normally found in the workplace has "potentially toxic effects in such concentrations as used or found." If such a determination is made, NIOSH is required to submit it immediately to OSHA so that OSHA can issue a standard.

With regard to OSHA's general standard setting authority, the Act prescribes no criteria other than the requirement that standards serve the purposes of the Act, i.e., assure safe and healthful working conditions. However, in the case of toxic materials and harmful physical agents, OSHA is required to set a standard:

> "which most adequately assures, to the extent feasible, on the basis of the best available evidence, that no employee will suffer material impairment of health or functional capacity even if such employee has regular exposure to the hazard dealt with by such standard for the period of his working life."

The extensive scope of this criterion is somewhat balanced by the further requirement that such standards are to be based on "research, demonstrations, experiments, and such other information as may be appropriate," considering not only "the attainment of the highest degree of health and safety protection for the employee" but also the "latest available scientific data in the

field, the feasibility of the standards, and experience gained under this and other safety laws."

The Act establishes an administrative body, the Occupational Safety and Health Review Commission to adjudicate appeals from agency enforcement actions. Standards promulgated by OSHA are not reviewable by the Commission, but rather are subject to judicial review in the various federal circuit courts of appeal. The statute states that the determinations underlying an OSHA standard shall be conclusive if supported by "substantial evidence in the record considered as a whole."

The Occupational Safety and Health Act is much less detailed in its regulatory scheme than are the Clean Air and Water Acts already described. Nevertheless, the foregoing sketch of some of its principal provisions is not intended to be complete or comprehensive. Rather, it is intended to lay the predicate for a brief discussion of some of the problems encountered in the Act's implementation. Like the other two major environmental, health and safety statutes, the Occupational Safety and Health Act has proved overly ambitious in its goals and has encountered significant problems in its execution.

- "National Consensus Standards"

Within weeks of the effective date of the Act, OSHA promulgated a torrent of national consensus standards --many of which were completely unfamiliar to the affected employers. As noted above, OSHA was statutorily charged with adoption of such standards within two years and "as soon as practicable" during that period. Many of these standards originated as aspirational recommendations of private standards setting organizations--describing optimum workplace safety and health--without intention or expectation that they be given the force of law. Many employers affected by these national consensus standards, when issued as mandatory OSHA standards, had not in fact participated in any significant manner in their formulation. Their immediate adoption without full, formal administrative process, denied such employers an opportunity to comment upon them. In addition, many of these national consensus standards, when given the force of law, appeared silly or inappropriate, undercutting employer respect for the regulatory process.

Of course, this unfortunate outcome is, in measure, the result of statutory mandate rather than bureaucratic ineptitude, for the statute, in prescribing a two-year deadline and an abbreviated administrative process did not allow OSHA time to consider the reasonableness of applying all such standards across the board to widely varying industries with differing workplace characteristics.

In part because of the frustration and controversy caused by its safety standards--many of them national consensus standards--and because of criticism that it has not acted with adequate vigor to regulate worker health problems, OSHA has recently determined to place emphasis upon the development of health standards regulating toxic substances or harmful physical agents.

- Emphasis on Engineering Controls

While the Act contemplates the promulgation of standards which assure the greatest feasible protection to the employee's safety and health, it contains no specific requirement that engineering controls be preferred over administrative controls (e.g., duration of work shifts) or personal protective devices (e.g., ear muffs, respirators, etc.). OSHA, however, has taken the position that engineering controls are preferable to administrative controls and especially to personal protective devices, and that the latter will not be considered a substitute for the former.

OSHA's insistence on engineering controls has shown itself most strongly in its noise abatement efforts. Engineering controls to reduce noise are, in many cases, very costly; yet personal protective devices such as ear plugs or ear muffs may often lower the effective noise levels for individual workers significantly below the level now established in guidelines. However, only when engineering and administrative controls fail to bring noise levels, or duration of exposure to them, below permissible levels, is the use of personal protective equipment allowed (and is, at that point, required).

One consequence is that an employer may undergo substantial expense to institute engineering controls which must still be supplemented by personal protective devices (at an additional cost), when use of the personal

protective devices alone would have eliminated the noise level problem.

OSHA's strong emphasis on engineering controls may, therefore, place significant financial burdens on employers while achieving only marginal improvements over alternative methods such as personal protective devices. As OSHA will likely place continued emphasis on setting standards for reducing worker exposure to toxic and carcinogenic substances, its rigid adherence to engineering controls, in preference to lower cost personal protection devices, has very substantial economic implications for American industry.

- Responsibility Exclusively the Employers

OSHA's strong emphasis on engineering controls can be explained in part by the fact, already noted, that the Act contains no enforcement mechanism with regard to employee obligations.

While the Act purports to recognize the "separate but dependent responsibilities and rights" of employer and employee "with respect to achieving safe and healthful work conditions," the obligation for such achievement is placed totally on the shoulders of the employer. The employer's obligation to adhere to standards and to furnish a workplace free from recognized hazards is enforced through the inspection and citation procedures established in the Act. On the other hand, the Act does not provide any procedures to enforce the employee's statutory "obligation" to comply with OSHA standards.

In one closely followed case, a stevedoring company was cited by an OSHA inspector for violation of a regulation requiring the use of hard hats. The employer defended itself on the grounds that, notwithstanding various exhortations, posting of signs and other means of persuasion, the longshoremen had continually refused to wear hard hats. Moreover, the employer produced evidence that any attempt to enforce the standard would have resulted in a wildcat strike by its employees. A federal court accepted the employer's evidence that in the circumstances enforcement efforts would indeed have resulted in a strike. Nonetheless, the court held that employee non-compliance was not a defense under the Act and that it was the employer's responsibility, through collective bargaining,

to obtain the right to discipline its employees for violation of safety standards.*/

Thus, it is fair to conclude that OSHA's predilection for engineering controls is, in measure, a result of the statutory scheme. Since the Act requires OSHA to assure the greatest feasible protection of workers' health, and because it provides no direct means to enforce employee compliance with protective device requirements, OSHA finds it prudent and necessary to place emphasis on steps solely within employer competence, such as engineering controls--despite their very high relative cost.

● Costs and Benefits in Standard Setting

As already noted, the Act requires OSHA to regulate workplace exposures to "toxic materials or harmful physical agents" in a fashion that most adequately assures "to the extent feasible," protection of worker health, despite regular worker exposure to the hazard through a working life. Neither the Act nor its legislative history elaborates the meaning of this feasibility requirement. It has, therefore, become the centerpiece in continuing legal controversy regarding the scope of OSHA's regulatory discretion. Businessmen have argued that economic costs are a criterion in setting toxic standards. Public interest groups have argued that the only "feasibility" intended by the statute is technological feasibility. Thus these latter groups argue that if engineering controls to reduce worker exposure are technically feasible, they should be mandated for application, regardless of their cost and the ensuing economic consequence for the affected industry.

The ramifications of this debate are very substantial. NIOSH has prepared a list of approximately 1,600 potential carciogens. To date, however, only 16 health-related standards have been promulgated by OSHA. As numerous additional standards are prepared, the willingness and legal capability of OSHA to take account of economic feasibility will be of vital

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*/ Atlantic & Gulf Stevedores v. OSHRC, 534 F.2d 541 (3rd Cir. 1976).

importance in assessing the "reasonableness" of the regulatory scheme of the Act.

The criterion of feasibility has not, to date, been accorded any unequivocal interpretation by OSHA or by federal courts. In the case of vinyl chloride, OSHA sought to "force" technology, and when the industry appealed the standard, OSHA's action was approved by the reviewing federal court. In regulating asbestos, OSHA allowed a four-year period for industry to come into compliance. Labor unions appealed the exercise of discretion. The court found that the Act did not "require immediate implementation of all protective measures, technologically achievable without regard to their economic impact," and that a "prohibitively expensive" standard would not be considered feasible.*/ In effect, courts have been willing to give great weight to OSHA's exercise of delegated "legislative" discretion to make essentially "political" judgments and have not been disposed to read into the requirement of feasibility anything but a "gross" concern for costs of compliance.

Recently, in promulgating standards for occupational exposure to coke oven emissions, OSHA showed responsiveness to both technological and economic concerns. However, economic concerns were addressed only to determine whether the impact of the proposed standard was "within the financial capability" of the steel industry. No precise analysis was done of the economic cost of the standard in relation to the likely human health benefits of its implementation.**/

In assessing likely human health consequences of degrees of regulation of potentially harmful or carcinogenic substances, OSHA faces the same dilemma encountered by EPA in its regulation of "hazardous pollutants." Scientific evidence is not available to establish a "safe" threshold of occupational exposure. In addition, the capability to monitor actual emissions to a level of accuracy necessary to enforce such a

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*/ Industrial Union Department, AFL-CIO v. Hodgson, 499 F.2d 467, 477-478 (D.C. Cir. 1974).

**/ See 41 Fed. Reg. 46742 (1976).

regulation may not exist, even if such thresholds could be scientifically established. The greater the nature and degree of risk posed by failure to regulate stringently, the greater the political and legal pressures for vigorous regulatory intervention--despite uncertainty regarding actual costs and benefits of such intervention. Where "non-threshold" carcinogens are involved, it is argued that "zero" exposure is the only permissible standard. The net result may be a regulatory goal of "no cancer" regardless of the cost of attainment, while a less stringent regulation allowing the possibility of "some cancer" is not politically tolerable, however merited on grounds of "regulatory reasonableness."

- Uncertainty and the Future

The degree of scientific uncertainty that attends these issues, together with the vague breadth of the statutory requirement that OSHA consider "feasibility," endows the Administrator of OSHA with immense discretion which, in turn, must be exercised in a political and legal crucible. The potential for regulatory intervention by OSHA "to assure . . . that no employee will suffer material impairment of health . . ." throughout a working lifetime, is immense. The possible cost of such intervention, large on its face, is compounded by the statutory and administrative predilection for engineering controls instead of personal protective devices. While the Toxic Substances Control Act, passed by the 94th Congress may, in the future, have the effect of reducing the number of toxic substances requiring OSHA regulation, presently OSHA is invested with vast discretion to regulate toxic substances. The exercise of this discretion is not circumscribed by statute or practical expectation so as to require other than the most rough consideration of costs as compared to the benefits of regulation.

Costs and Benefits: A Review of Current Empirical Evidence*

The recitation of evidence which follows in this section will undoubtedly prove tedious for some. The short of the matter is that current empirical evidence is mixed as to the rationality of current regulatory policy, and in any case, highly inadequate. That fact, in and of itself, is significant.

The section reviews available evidence as to costs and benefits as follows:

(1) review of aggregate economic impact data (pp. 58 -63);
(2) review of industrial economic impact data (pp. 64 -68);
(3) review of regional data (pp. 69 -93);
(4) review of benefit data (pp. 94 - 100);
(5) discussion of selected costs and benefits (pp. 101- 109);
(6) summary and exhibits;
(7) bibliographical notes.

(1) Review of Aggregate Economic Impact Data**

Legislation, particularly regarding the environment, represents a heterogeneous mix of objectives, which range from aesthetics to matters of life and death. The concept of environmental protection is often vague, difficult to define with any precision, and not readily reducible to a common denominator. In contrast, economic growth, with which environmental protection is frequently compared, refers to the growth rate of some national accounting aggregate, usually the Gross National Produce (GNP). It is a precise concept, operationally defined and capable in principle of exact measurement--even if in several respects it is unsatisfactory. Not surprisingly, reliable economic impact information is far more readily available than reliable benefit data.

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* The principal drafting of this section, drawing on sources noted, was by the Office of Regulatory Economics and Policy. Bibliographical references cited in this section are listed as a note at the end of the section (p. 119).

** Because of the nature of the data, a distinction must be made between national expenditures and business expenditures. National expenditures data are available from BEA for the years 1972-1973. Forecasts of national expenditures are made by the Council on Environmental Quality (CEQ). National expenditures include capital, operating, and maintenance costs of business, consumers, and government. Business capital expenditures data are available from McGraw-Hill for the years 1967-1975 and from BEA for the years 1973-1976. Unless otherwise noted, McGraw Hill data have been used throughout this paper.

Studies of the impact of regulations issued in accordance with environmental, safety and health legislation are not numerous, even though the subject has gained widespread interest. Studies of the impact of regulations taken together have been initiated only recently; most have not yet been completed.

The Recent Picture. Business, consumer, and government expenditures to achieve environmental, safety and health objectives were $22 billion in 1972 and $25.5 billion in 1973. These estimates are incomplete since they do not include operating and maintenance costs for the Occupational Safety and Health Administration (OSHA)-issued regulations and they do not include all operating and maintenance costs of business for environmental protection. Expenditures for pollution abatement and control were estimated by the Bureau of Economic Analysis (BEA) to be $19.5 billion in 1972 and $23 billion in 1973.[20,35] Expenditures by business to comply with OSHA regulations were estimated by McGraw-Hill to be $2.5 billion in 1972 and $2.5 billion in 1973.[17]

National expenditures for environment, safety and health represented 1.9 percent of Gross National Product (GNP) in 1972 and 2.0 percent in 1973. Preliminary data indicate that national expenditures exceeded 2.0 percent of GNP in 1975.

Business spent $34.8 billion from 1967 to 1974 to achieve environmental, safety and health objectives.* Approximately $15.7 billion (45%) of this total were spent for control of air pollution. Eleven billion dollars (32%) were spent on water pollution control. The balance of $8.1 billion (23%) was spent for compliance with OSHA regulations.

In 1975, capital expenditures by business for pollution control totaled $7.7 billion, of which $4.3 billion went for air, $2.4 billion went for water, and $1.0 billion went for solid waste.

*These estimates do not include operating and maintenance costs associated with environmental and employee protection. Estimates of business operating and maintenance costs are not available for the 1967-1974 period. Estimates of capital and current account expenditures by consumers and government are also not available for the 1967-1974 period.

Projected Expenditures. Over the period 1975 through 1984, the Nation will spend $486.2 billion, according to CEQ.[17] Of this total, $258.8 billion is due to environmental legislation. The capital costs of employee safety and health have been averaging $2.7 billion a year. Accordingly, one would expect OSHA to add $25 to $30 billion capital expenditures to the 1975 to 1984 expenditures estimate. Operating and maintenance costs of employee protection, for which data are unavailable, would be additional.

The CEQ projections include only the compliance costs of existing environmental legislation and regulations. They do not include costs associated with regulations which are forthcoming. Costs associated with forthcoming regulations are sizable, as can be seen in the following examples:

- The Environmental Protection Agency (EPA) estimated that the significant deterioration provisions included in the proposed Senate amendments to the Clean Air Act would increase the capital requirements of the electric utility industry by more than $11 billion over the next 15 years. These costs are in addition to the $44 billion to be spent between 1975 and 1984 for pollution control.[42] The significant deterioration provisions will increase the capital and operating costs of other industries also. As yet, there are no estimates of these costs.

- According to EPA, implementation of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended, will require one-time costs to industry of $495 million and annual costs of $106 million.[14]

- The projected costs of toxic substance control to the chemical industry vary widely.[13] EPA estimates control will cost $80-140 million. The Manufacturing Chemists Association (MCA) estimates control will cost from $358 million to $1.3 billion, depending on the degree of control. Dow Chemical Company estimates the cost of control to be in the neighborhood of $2 billion. The General Accounting Office (GAO) review of these estimates considered the EPA estimate to be the most reliable, Dow Chemical's to be overly high, and the MCA estimate to be believable.

- According to a Synthetic Organic Chemical Manufacturing Association (SOCMA) -sponsored study by Foster D. Snell, the cost to the chemical industry of OSHA's Standards Completion Project (SCP)--a program to protect workers from potentially harmful substances --will cost the chemical industry $421 million in capital costs, $422 million in non-capital start-up costs, and $367 million annually for continuing costs.[22]

- OSHA estimates that industry will have to spend $10.5 billion in capital expenditures to meet the existing 90dBA noise level requirements. Since much of industry is not in compliance with the 90dBA level, presumably all or a sizable portion of the $10.5 billion has yet to be spent. The cost of moving from the 90dBA level to the 85dBA level will cost an additional $8 billion.[4]

- The OSHA-proposed coke oven standards will result in increased capital and operating costs for the steel industry. Estimates of the capital requirements to comply with these regulations range from $451 million to $760 million according to studies for OSHA and the American Iron and Steel Institute. The estimates of additional operating expenses range from $173 million to over $1 billion annually.[33]

- OSHA estimates that its proposed arsenic standards will result in increased capital and operating costs to nonferrous metal smelting, agricultural chemicals (wood preservative and pesticide manufacturers) and glass manufacturing.[3] Capital requirements to comply with the four microgram arsenic standards are estimated to be $273 million; operating and maintenance costs are estimated to be $56 million. On an annualized cost basis, this translates into $111 million per year in compliance costs. There are indications that some OSHA estimates are low. Kennecott and American Smelting and Refining Company (ASARCO), for example, estimate that their costs are nearly double the OSHA estimate, $40.5 million rather than $22 million.[2]

If the costs reflected in these examples are taken into account, total costs to industry will be increased by $65 to $68 billion.

In addition to expenditures incurred directly by business and by government, public costs are incurred by budget allocations for programs to alleviate adverse effects upon individuals (workers who are unemployed as a result of plant closings), industries (small business firms which obtain funding from federal agencies), and communities (which may suffer relatively heavy unemployment and become eligible for federal assistance).

Macroeconomic Impacts. The CEQ and EPA periodically estimate the impacts of environmental expenditures on the U.S. economy. A comparable analysis of the effects of safety and health related expenditures is not available. The most recent CEQ-EPA analysis indicates that over the period 1976 to 1983, the aggregate impacts of pollution control on key economic aggregates will be substantial, and will greatly exceed earlier projected impacts.[17]

Projected real GNP is slightly higher in 1976 as a result of pollution control expenditures. However, in 1977 and subsequent years, GNP will be lower as a result of pollution control--2.2 percent lower by 1983. The slower growth after 1976 is primarily a result of the dampening effect of price increases resulting from environmental expenditures and a decline in the growth of environmental expenditures.

Prices, as measured by the Consumer Price Index (CPI), will be 4 percent higher in 1983 with pollution control than they would be without pollution control. Although prices are expected to increase by 4 percent, relative prices, which are not fully reflected in aggregate price indexes, will change by considerably greater amounts. For example, the price of electric power will increase from 7 percent, EPA estimate,[36] to 15 percent, electric utility industry estimate.[37]

Many industries predict (see industry discussion) that compliance with environmental, safety and health regulations will slow their rate of capacity expansion. It is likely that reductions in capacity expansion will interrupt the smooth flow of goods and services. These bottlenecks will tend to increase prices and reduce output. Among manufacturing industries pollution control expenditures tend to be concentrated in a few industry groups. In 1973 and 1974, 66 percent and 69 percent, respectively, of all abatement expenditures for capital equipment were concentrated in four major industries: primary metals, chemicals and allied products, paper and allied products, and petroleum and coal. Prices in these industries will be more strongly affected than in industries with relatively low rates of environmental expenditures.

CEQ and EPA estimate that environmental expenditures will add to total employment over the period 1976-1981. The employment rate will be roughly one-half percent higher in 1977. The differential will decline to zero by 1981. After 1981 environmental expenditures will have a small negative effect on the employment rate. The small negative effect coincides with economic recovery. Overall, in the long-run, the net impact on employment is not expected to be significant.

It is difficult to determine with precision and in total the ramifications of environmental expenditures on the U.S. economy. The interrelationships between economic variables and activities are numerous and complex. Macroeconometric models provide a framework for the assessment of the impacts of regulations. However, the nature of these models, as well as the complexity of the problem, is such that their results can be taken as only rough indications of the ultimate impacts of the environmental expenditures.

Typically, the models are demand oriented with a limited ability to reflect the effects of regulations on supply. They do not adequately allow for potential bottlenecks nor do they capture the responses to these shortages. A major shortcoming is the level of disaggregation in the industrial sectors of the models; the sectors are too broad to identify specific products or materials, the supplies of which may be adversely affected by regulatory requirements.

The assessments of the impacts of environmental regulations made by macroeconomic models must be supplemented by a consideration of impacts on specific industries and products. Some indication of these micro level impacts is given in the section on Industrial Impacts.

(2) A Review of Industrial Impact Data

Industrial Expenditures. Between 1967 and 1975, business made capital expenditures of $45 billion to comply with environmental, safety and health regulations--$34.8 billion for environmental protection and $10.3 billion for safety and health, (exclusive of operating and maintenance costs, for which there are no estimates). The available estimates of environmental operating and maintenance costs, covering manufacturing industries and electric utilities in 1973, suggest that business incurred in excess of $3.5 billion in operating and maintenance costs to comply with environmental regulations alone.

The burden of pollution abatement capital expenditures falls most heavily on a few industries. From 1967 to 1975, six industries spent in excess of $2 billion each on pollution abatement capital goods. Electric utilities spent over $6.5 billion. Petroleum spent over $4.5 billion. Chemicals and paper spent over $2.5 billion each. Iron and steel and nonferrous metals spent over $2 billion each.

Expressing the capital requirements to meet regulatory requirements as a percent of total capital spending enables more meaningful comparisons and better indicates the potential impact of regulations.

Using Bureau of Economic Analysis (BEA) estimates in 1975, the following industries had the largest antipollution spending as a percent of total capital spending:

Nonferrous Metals	24.2 percent
Paper	16.8
Stone, Clay, and Glass	14.3
Blast Furnaces, Steel Works	13.5
Petroleum	11.8
Chemicals	10.9
Electric Utilities	9.7

Capital expenditures to meet Occupational Safety and Health Administration (OSHA) standards affect a somewhat different group of industries. In 1975, the six industries spending the most were:

Commercial, $494 million; Communication, $268 million; Petroleum, $263 million; Chemicals, $200 million; Electric utilities, $170 million; Nonferrous metals, $150 million. As a percent of capital spending, the top spenders for OSHA were:

Instruments	10.1 percent
Nonferrous Metals	6.6
Stone, Clay, and Glass	5.9
Rubber	5.7
Textiles	5.7

The combined impact of total expenditures to meet environmental, safety and health regulations is impressive in terms of the percent of total capital spending for compliance. The following lists for high impact industries the combined percentage of capital spent in 1975 for environmental, safety and health:*

Nonferrous Metals	30.8 percent
Paper	19.0
Stone, Clay, and Glass	20.2
Blast Furnaces, Steel Works	15.4
Petroleum	14.3
Chemicals	14.1
Electric Utilities	10.7

Projected Impacts. There are numerous indications that existing and proposed environmental regulations are stringent and that compliance with the regulations will have adverse effects on productivity and growth. It appears that some industries will not be able to finance investment for both compliance and capacity growth, and that industry will be unable to maintain U.S. self-sufficiency in critical materials. For example:

*These percentages are based on BEA data for pollution spending and McGraw-Hill data for OSHA. BEA data tend to be of a lower magnitude and percent than McGraw-Hill data. For example, using all McGraw-Hill data for 1975, the nonferrous metals industry devoted 34.1 percent of its total capital expenditures to anti-pollution and safety and health. The differences between BEA and McGraw-Hill estimates of expenditures are being explained in a forthcoming Regulatory Policy Committee technical paper.

- Environmental regulations will constrain the electric power industry's use of coal, consume large amounts of capital--$44 billion over the next ten years, and increase consumer costs by an average of 15 percent.[37]

- The copper industry finds that each layer of new or reinterpreted regulations adds another layer of cost. An example is the proposed disallowing of supplemental control systems (SCS) as a control strategy. This will add $500 to $700 million to the $1 billion base compliance cost of the Clean Air Act. Consequently, the copper industry may encounter difficulties in adding new capacity and maintaining U.S. self-sufficiency in copper.[39]

- The OSHA-proposed arsenic standards may force the closing of the American Smelting and Refining Company (ASARCO), Tacoma, Washington smelter. This smelter is the only U.S. producer of metallic arsenic and arsenic trioxide. The annual cost of compliance for the Tacoma smelter is estimated to be $9.9 million by OSHA[3] and $14.3 million by Arthur D. Little, Inc. (ADL)[2] in an analysis performed for ASARCO. The average net pretax income of the Tacoma smelter is $1.9 million per year. Clearly, the Tacoma operation cannot absorb these costs. The ADL analysis concludes that the costs cannot be passed back to the mines supplying smelter feed nor forward to purchasers of copper or arsenic. If the Tacoma smelter is closed, the U.S. will lose 7 percent of U.S. copper smelting capacity and be completely dependent on foreign suppliers for arsenic trioxide. Additionally, the arsenic standards will result in the loss of 3,000 jobs (3,700 if Tacoma closes) and result in a 21 percent increase in the price of arsenic-preserved wood products.

- The petroleum industry expects to spend $19.2 billion for environmental control. The industry projects that if it is unable to increase capital expenditures, domestic oil imports could rise to 70 percent of U.S. consumption by 1990. The industry estimates that only half of the $19.2 billion for environmental control is net beneficial and that society would benefit more by investments in new productive capacity.[15]

Another area of concern is the effect of pollution control on employment. The Environmental Protection Agency (EPA) monitors job losses attributable to plants closed because of pollution control regulations.[45] EPA has determined that about 82 plants have closed because of environmental regulations. These closings affected approximately 17,000 to 18,000 employees. The bulk of

the plants closed were old plants with dated facilities and high costs of production relative to other plants in the industry. The EPA estimates exclude plant closings and job losses where environmental requirements were not the primary reason for closing. This practice underestimates the actual impact on employment. For example:

- Kennecott Copper recently curtailed copper production in its Nevada Mines Division. This action was taken because of the current weak market for copper and air emission regulations which were more stringent than necessary to meet National Ambient Air Quality Standards (NAAQS). If this plant is closed, it is likely that the job loss (1,200) would be attributed solely to economic conditions.[39]

- Ford Motor Company estimates that price increases to cover the cost of complying with 1977 emission controls will lower their auto sales.[39] The reduction in auto sales would force a reduction of 75,000 in Ford's work force.

To accommodate new entrants to the work force, the U.S. must create 1.5 to 2.0 million jobs per year. The Council on Environmental Quality (CEQ) and EPA argue that abatement expenditures will create more jobs than are lost through plant closings. For example, the CEQ argues as follows:

- During 1976, abatement expenditures will be approximately $35 billion, or about 2 percent of Gross National Product (GNP). If these expenditures result in an additional 2 percent of the labor force being employed, then almost 2 million jobs will be created.[17]

There is no reason to expect that such a correspondence really exists. Environmental expenditures do create jobs. The question is the net number of jobs created. The CEQ-EPA estimate is a gross estimate and, therefore, does not consider how many jobs were lost or not created. The magnitudes can be significant, as the following examples show.

- The paper industry projects that by 1984 compliance with existing environmental regulations will preclude the creation of 63,000 paper industry jobs. Taking into account the effect on supplier and customer industries, a total of 440,000 jobs will not be created.[47]

- The steel industry calculates that a billion dollars invested in environmental controls will create 610 new jobs, while a billion in new productive capacity will create 7,800 jobs.[38]

- Preliminary estimates by the chemical industry suggest that a million dollars invested in manufacturing facilities results in 13 jobs while the same amount invested in environmental protection facilities results in 5 jobs. Each manufacturing job creates 2 to 3 jobs in customer and supplier industries. Environmental protection jobs have little, if any, such effect.[23]

The National Bureau of Economic Research (NBER) has been exploring the industrial impacts of the Federal Water Pollution Control Act (FWPCA).[30] Preliminary findings indicate "impacts" occur at the industry level and at the plant level. The plant level impacts are the most significant. On the industry level, the near-term effects of water pollution controls can lead to short-term capacity constraints, which in turn can lead to price increases in excess of any direct cost increases associated with controls. Impacts are most noticeable during periods of high capacity utilization, which implies that the timing of controls with respect to the state of the business cycle is an important determinant of "impact."

In the long-run, pollution control requirements cause changes in an industry's cost structure. These changes can have significant effects not readily observable in product price changes. Economies of scale in wastewater treatment are less available to small plants; the size of the economically minimum sized plant is increased. The first effect tends to reduce the number of small plants and the second effect acts to raise barriers to entry into the industry.

The economic impacts of environmental, safety and health regulations on industry have been studied separately. It is difficult to ascertain whether the combined costs of all regulations will drastically affect a firm's or industry's prices, profits, productivity, or employment when the available studies presumably show that the effects of different regulations estimated separately are minor.

In terms of magnitudes, in 1974, approximately 7 percent of GNP was allocated to all educational programs and a similar percentage to health. In comparison, the National Economic Research Associates (NERA) estimates that between 3 to 6 percent of GNP will be allocated to compliance with the requirements of the Clean Air Act and the FWPCA. The NERA estimate does not include the impact of safety and health regulations.

For an illustrative, more detailed examination of the impacts of regulation on two industries which are particularly adversely affected--the copper and paper industries--see Appendix A.

(3) A Review of Regional Data: Regional Impacts of Environmental Regulations

The local or regional implications of achieving environmental, safety and health improvements have received very little attention. Most analyses of the costs and benefits of regulations have stressed the macroeconomic and industrial implications.

The allocation of resources to meet these objectives has been significant and is growing rapidly--national expenditures for these purposes represented 2.0 percent of GNP in 1973. While these expenditures have significant implications for specific industries and the economy as a whole, their impacts on regions may be even greater.

In a macro sense, some of the negative impacts associated with these efforts may be offset. For example, while employment may decline or growth in jobs diminish in some industries, jobs may be created in other industries. However, the reallocation of resources between economic activities very likely will involve substantial reallocations between regions as well. The spatial shifts of population, resources, and production may be detrimental to some regions and beneficial to others.

In some areas, the disruptions may involve production and job losses. These losses may impose additional costs on the local communities--revenue losses as the revenue base is eroded or additional expenditures for relief to unemployed workers. To the national economy, the costs of meeting these national objectives may be transitory. To specific regions, the costs may be permanent.

The essential issues in the consideration of the regional impacts of federal regulations are:

- Do uniform federal regulations have uniform regional impacts?
- Will federal regulations significantly constrain economic growth in some regions?
- Do federal regulations conflict with goals for the development of economically depressed areas?

The available data are inadequate to address these issues. The analysis that follows deals with the narrow issue of the regional costs of environmental regulations. The purpose of the analysis is to demonstrate the extent to which the costs and impacts of environmental regulations vary between regions.

Measuring Regional Costs and Benefits

To date, very little work has been done to allocate the costs of environmental regulations to regions or to relate those costs to regional benefits. The data and projections presented below provide a preliminary assessment of the regional distribution of some of the costs associated with pollution abatement. Where possible, an assessment is made of the benefits the regions will gain. It should be noted that the costs and benefits cited are not incremental, i.e., are not those occurring solely because of regulations. A measurement of incremental costs and benefits to regions is not possible, given current data limitations.

The size of region selected for study is important. A small region (county, SMSA) may be necessary to thoroughly measure the direct costs and benefits associated with pollution control. However, too small a region may not be operational for national policy analysis. On the other hand, a large region (multi-state) may be useful to reveal major geographical cost differences, but may be too large to identify the regional implications of national policies.

Selection of region size is determined by the availability of data. A case study approach at the community level is costly, time consuming and typically limited due to data problems. A few studies of this nature have been done and will be reviewed below. The analysis presented here concentrates on larger areas--states and multi-state areas.* Data and projections are more numerous for these areas. Also, they are adequate for the purpose of this paper--to demonstrate that there is considerable regional variation in costs and benefits associated with achieving national standards.

Historical Estimates: Capital Expenditures. The Bureau of the Census has published survey-based estimates of pollution abatement costs and

*See page 77 for a listing of the BEA regions and their composition by states.

expenditures by major manufacturing industries for 1973 and 1974.[11,12] The estimates are published for multi-state regions, states, and major SMSAs.

Pollution abatement capital expenditures by manufacturing industries vary considerably between regions (Table 1). These differences reflect the size and structure of the industrial sector of the regions. Pollution abatement expenditures (adjusted for size of the region) represented 15 percent of the total capital expenditures made by manufacturing industries in the Southwest region in 1973 (Table 2). The comparable figure for all U.S. manufacturers was 9 percent. Manufacturers in the Rocky Mountain region devoted 11 percent of capital expenditures to pollution control. The smallest percentage, 5 percent, occurred in the New England region.

Historical Estimates: Annual Costs. There are regional differences in the distribution of annual costs between forms of pollution abatement (Table 3). Relative to the U.S. as a whole and the other regions, annual costs in the Rocky Mountain, Far West, and Mideast regions were more concentrated in air pollution abatement. Costs in the Southeast, Southwest, and New England regions were relatively more concentrated in water pollution abatement.

The annual costs per unit of pollutant removed* for air were several times higher in the New England region than in the other regions, according to data for 1973 and 1974 (Table 4). The unit costs for air pollution control were $81 in 1973 and $89 in 1974 for the New England region. The comparable figures for the U.S. were $15 in 1973 and $20 in 1974. The costs per unit of pollutant removed through solid waste collection and disposal were also considerably higher in both years in the New England region--$13 and $12 for New England, $6 and $5 for the U.S. as a whole.

*The calculation of annual costs per unit of pollutant removed from only two years of data may be misleading. The amount of pollutants removed in a region may vary significantly from year-to-year (see Table 9). These amounts may reflect any number of current and previous control activities and, therefore, may not be directly attributable to the annual costs reported in the same year.

Quantities of pollutants removed through water pollution control are not reported by the Bureau of the Census.

The extreme variation between New England and the other regions in terms of costs per unit of pollutant removed may result in part from economies of scale in the removal of pollutants. Annual costs per unit for air pollution abatement and solid waste disposal were more than three times greater in the New England region than in the Southeast region. The New England region accounted for only an average of 1.3 percent of the total pollutants removed in the U.S. for the two years and 3.5 percent of the total annual costs. On the other hand, the Southeast region accounted for an average of 28 percent of total pollutants removed and 20 percent of total annual costs.

There are exceptions to the relationship between quantities of pollutants removed and unit costs per unit of pollutant. The Rocky Mountain region, which had the lowest costs per unit of pollutant removed, accounted for less than 4 percent of the total pollutants removed. The overriding factors explaining the regional cost differences are more likely to be the types and quantities of pollutants generated, which, of course, depend on the size and structure of the industrial sector in each region.

Though regional data on pollution abatement costs and expenditures by industry are sketchy due to disclosure problems, some tentative conclusions can be made about regional variations. It is apparent that there are considerable cost differences between industries within a region and between regions for a given industry. Tables 5 through 8 provide information on costs of air pollution abatement and solid waste collection and disposal for selected industries, by state.

The implications of these regional and industry cost differences have not been fully analyzed. However, to the extent that environmental costs differ for industries between regions, competitive cost advantages may be created. (The allegations regarding the Mahoning Valley are an example.) Firms incurring higher pollution abatement costs in one region may be at a competitive price disadvantage in comparison with firms operating in regions with lower industry abatement costs. The result may be a shifting of production and employment to the lower cost region. This geographical reallocation of resources might occur even though the resource and production levels for the industry as a whole remain the same. Thus, while the aggregate impacts may be small, the regional implications may be considerable.

Historical Estimates: Benefits. The quantity of pollutants removed is, at best, a crude proxy for the myriad benefits of pollution control. The quantity of pollutants removed indicates nothing about the resulting condition or quality of the environment; it does not

measure the enhancement of the health, safety, esthetic, or recreation value of the environment. However, it is the most generalized, quantifiable information currently available for numerous regions.

As in the case of costs, the quantities of pollutants removed vary considerably between regions (Table 9). The regions with large polluting industries recorded the largest quantities of pollutants removed. The Southeast region accounted for 28 percent of total pollutants removed in two years. Figures for the other regions were: Great Lakes, 25 percent; Mideast, 16 percent; Far West, 11 percent; Southwest, 10 percent; Plains, 6 percent; Rocky Mountain, 4 percent; New England, 1 percent.

Projected Costs. Projections have been made of the aggregate costs and expenditures for pollution abatement that will be made over the next ten years by the business and public sectors of the U.S. economy. No comparable projections have been made for the various geographical regions of the country.

To provide a projection of business capital expenditures for pollution abatement on a regional basis, the Bureau of Economic Analysis (BEA) national estimates[5] have been allocated to the eight regions. The allocation was based on historical and projected regional industry earnings data. The earnings projections were developed by the Regional Economic Analysis Division, BEA.[6]

The regional projections, by manufacturing industry, are presented in Table 10. The estimates are cumulative for the period 1971-1980 and are in constant (1972) dollars.

The largest expenditures will be made by the petroleum, primary metals, chemicals, and paper industries. Based on the current and projected geographical distribution of these industries, the major impacts will be concentrated in only a few regions.

The Great Lakes and Mideast regions together will account for approximately half of the total pollution abatement investment expenditures. The Southeast region will account for about 17 percent of the total and the Far West about 12 percent. The remaining regional shares are: Southwest, 10 percent; Plains, 6 percent; New England, 5 percent; Rocky Mountain, 2 percent.

Water Quality Improvement. Available case studies show the variation that will occur in regional costs and benefits from water pollution abatement.[31] Evidence gleaned from these studies indicates that:

- Water quality improvements, the allocation of compliance costs between industry and local government, and the ability to protect water quality and support economic growth vary significantly between regions.

- In general, the abatement programs are more stringent for the private sector. The relative portion of the total pollutant load discharged by publicly-owned treatment plants increases as more stringent requirements are met. In addition, the relative cost for the private sector is generally higher than its contribution to the total discharge.

Three examples illustrate the cost burdens and the degree of abatement achieved in situations typical of the regional studies. In Atlanta, the vast majority of discharges is from publicly-owned treatment works. In the Huntington, West Virginia/Ashland, Kentucky/Portsmouth, Ohio (HAP) area, the relative discharges from the public and private sector are approximately equal and in Charleston, the industrial discharges dominate.

The 1973 point-source Biochemical Oxygen Demand (BOD) load in the Atlanta area averaged 54,305 pounds per day. The municipal sector contributed about 52,179 pounds per day or 96 percent of the load. Compliance with the 1983 abatement level will reduce the BOD load to 24,300 pounds per day, an 11 percent reduction from the estimated 1977 load and a 55 percent reduction from the 1973 load. The total cost to go from the 1973 level of treatment to the 1983 level is about $185 million. The municipal share is about $181 million or 98 percent. The average cost per pound of pollutant BOD abated will be $6,381 for municipal governments and $2,439 for industry.

Huntington/Ashland/Portsmouth is representative of an area with major pollution problems, a high population out-migration rate and an economic dependence on a few industries subject to high abatement costs. The 1973 total BOD load in the HAP area from municipal and industrial point sources was 37,150 pounds per day, with industry contributing about 68 percent. Compliance with the 1983 requirements will reduce the BOD load to 8,520 pounds per day. The incremental cost to reach the 1983 level is $135.7 million. Industry's share is estimated to be 89 percent or about $120.6 million. The average cost per pound of pollutant BOD abated will be $5,156 for industry and $2,080 for municipalities.

In the Charleston, West Virginia area, industrial pollutant loadings far outweigh the municipal loadings, and water quality needs dictate stringent treatment levels to meet the 1983 goals of the Act. Industry contributes 84 percent of the BOD load to the Kanawha River; almost all of this is from the chemical industry.

Upon compliance with the 1983 effluent limitations, the 1973 BOD load will be reduced by about 81 percent. The estimated cost of going from the 1973 to the 1983 level is $170.3 million. The industrial share is $161.2 million or 95 percent. The average cost per pound of pollutant BOD abated will be $3,613 for the industrial sector and $1,673 for the municipal sector.

Job Dislocations. It is difficult to measure the full impacts of pollution abatement costs and expenditures on regional economies. In lieu of making the necessary expenditures to achieve environmental standards, some plants may close. Plant closures may represent lost production to the region and Nation. Or, production may be curtailed at plants with severe pollution problems and transferred to plants in other regions where plant or region characteristics are such that abatement costs are lower. Either of these adjustments involves regional economic dislocations.

The Environmental Protection Agency (EPA) monitors actual and potential job losses resulting from pollution control legislations.[45] To date, actual job losses (adjusted for size of region) have been unevenly distributed across regions (Table 11). The distribution of job losses that would occur from threatened plant closings is even more concentrated.

In 82 plant closings, pollution control costs were alleged to be a primary factor. These closings have resulted in the loss of nearly 18,000 jobs. Nine of the ten EPA regions have incurred plant closings.* The regional concentration of job losses is indicated by the figures below.

27% of closed plants (29% of lost jobs) were in Region II
18% of closed plants (24% of lost jobs) were in Region V
 2% of closed plants (2% of lost jobs) were in Region VII
 0% of closed plants (0% of lost jobs) were in Region VIII

*See Table 12 for a listing of the EPA regions.

Environmental requirements may force the closing of 32 plants, with 37,831 affected jobs. The bulk of these plants is in two EPA regions; 78 percent are located in EPA Region V and 17 percent are in Region IX.

Twenty-four thousand of the reported potential job losses (64 percent of the total) are employed at four primary metals plants located in Ohio (Mahoning River Valley). The steel companies that operate these plants have argued that the plants are too old to justify the installation of expensive pollution controls. They have threatened to close the plants rather than spend an estimated $140 million for pollution controls to reduce effluent discharges into the Mahoning River. These expenditures would be in addition to $150 million on equipment needed to reduce air pollutants from the plants.[46]

One economic stimulus which will occur from abatement expenditures is the creation of jobs associated with the production, operation, and maintenance of pollution abatement facilities and equipment. Estimates of the regional distribution of this activity are not available.

BEA Regions

New England

Maine
New Hampshire
Vermont
Massachusetts
Rhode Island
Connecticut

Mideast

New York
New Jersey
Pennsylvania
Delaware
Maryland
District of Columbia

Great Lakes

Michigan
Ohio
Indiana
Illinois
Wisconsin

Plains

Minnesota
Iowa
Missouri
North Dakota
South Dakota
Nebraska
Kansas

Southeast

Virginia
West Virginia
Kentucky
Tennessee
North Carolina
South Carolina
Georgia
Florida
Alabama
Mississippi
Louisianna
Arkansas

Southwest

Oklahoma
Texas
New Mexico
Arizona

Rocky Mountain

Montana
Idaho
Wyoming
Colorado
Utah

Far West

Washington
Oregon
Nevada
California
Alaska
Hawaii

Table 1

Pollution Abatement Capital Expenditures by Manufacturing Industries, by Region: 1973 and 1974

	Total (Millions of Dollars)		Percent Of U.S. Pollution Abatement Capital Expenditures[1]		Percent Of Region's Total Capital Expenditures	
	1973	1974	1973	1974	1973	1974
New England	70.2	97.5	3.0	3.2	5.1	NA
Mideast	367.3	500.2	15.7	16.4	8.0	NA
Great Lakes	473.8	544.4	20.3	17.9	6.4	NA
Plains	112.4	177.1	4.8	5.8	7.4	NA
Southeast	602.8	875.7	25.8	28.7	8.7	NA
Southwest	317.9	417.5	13.6	13.7	15.4	NA
Rocky Mountain	59.7	65.4	2.6	2.2	11.1	NA
Far West	335.7	370.5	14.4	12.2	12.0	NA

[1]Percentages calculated on U.S. totals which exclude amounts withheld from disclosure in regional detail.

Source: U.S. Bureau of the Census, Current Industrial Reports, Series MA-200(73)-2, Pollution Abatement Costs and Expenditures, 1973 and MA-200(74)-1, Pollution Abatement Costs and Expenditures, 1974.

Table 2

Annual Costs of Manufacturing Industries For Pollution Abatement, by Region: 1973 and 1974[1]
(Millions of dollars)

	Air Pollution Abatement		Water Pollution Abatement		Solid Waste Collection/Disposal		Total	
	1973	1974	1973	1974	1973	1974	1973	1974
New England	32.3	35.1	29.6	44.7	19.4	28.2	81.3	108.0
Mideast	205.9	270.2	151.9	192.8	96.2	131.4	454.0	594.4
Great Lakes	225.8	274.8	210.4	255.6	138.2	163.1	574.4	693.5
Plains	41.5	56.7	23.0	36.2	27.4	36.5	91.9	129.4
Southeast	179.4	245.6	195.3	260.8	101.1	133.2	475.8	639.6
Southwest	95.9	131.2	94.3	125.0	37.0	52.3	227.2	308.5
Rocky Mountain	25.6	28.9	13.6	15.3	9.9	12.0	49.1	56.2
Far West	154.3	167.9	97.4	122.6	62.0	75.2	313.7	365.7

[1]Annual costs include payments to governmental units for solid waste collection and disposal, depreciation charges, and payments for labor, equipment, leasing, materials, supplies, services, and miscellaneous items.

Source: See Table 1.

Table 3

Percentage Distribution of Regional Annual Costs, by Form of Abatement

	Air Pollution Abatement 1973-1974	Water Pollution Abatement 1973-1974	Solid Waste Collection/Disposal 1973-1974
United States	42.1%	36.2%	21.8%
New England	35.6	39.2	25.1
Mideast	45.4	32.9	21.7
Great Lakes	39.5	36.8	23.8
Plains	44.4	26.8	28.9
Southeast	38.1	40.9	21.0
Southwest	42.4	40.9	16.7
Rocky Mountain	51.8	27.4	20.8
Far West	47.4	32.4	20.2

Source: See Table 1.

Table 4

Annual Costs Per Unit of Pollutant Removed, by Region: 1973 and 1974[1]
(Dollars per Short Ton)

	Air Pollution Abatement		Solid Waste Collection/Disposal		Total Air and Solid Waste		Total Air and Solid Waste
	1973	1974	1973	1974	1973	1974	1973-1974
New England	80.5	88.7	13.1	11.6	24.4	19.9	21.7
Mideast	14.7	26.9	9.9	6.8	12.7	13.7	13.2
Great Lakes	14.4	22.8	5.2	5.6	8.5	10.6	9.6
Plains	9.1	10.9	6.7	5.6	8.0	7.9	7.9
Southeast	12.2	14.8	5.9	2.9	8.8	6.0	6.9
Southwest	12.5	19.2	4.9	3.8	8.7	9.0	8.9
Rocky Mountain	18.1	17.5	3.1	2.1	7.6	5.5	6.3
Far West	18.2	23.0	5.8	6.4	11.2	12.7	11.9

Source: See Table 1.

[1]Calculated from annual costs of establishments reporting quantities abated.

Table 5

ANNUAL COSTS PER UNIT OF POLLUTANT REMOVED, BY STATE AND INDUSTRY: 1973
AIR POLLUTION ABATEMENT
(Dollars per Short Ton)

		Paper Products	Chemical Products	Petroleum and Coal Products	Primary Metals	Fabricated Metals	Transportation Equipment
United States		10.7	18.3	15.5	23.6	10.1	81.4
NEW ENGLAND:	Maine	7.0	-	-	-	-	-
	New Hampshire	-	-	-	-	-	-
	Vermont	-	-	-	-	-	-
	Massachusetts	324.3	173.1	52.6	153.9	642.9	-
	Rhode Island	-	-	916.7	D	-	-
	Connecticut	239.1	275.2	-	320.0	285.7	318.2
MIDEAST:	New York	18.1	30.9	-	4.4	18.1	21.8
	New Jersey	15.4	56.8	13.3	69.6	25.8	250.0
	Pennsylvania	32.3	28.7	18.3	19.8	72.5	1,000.0
	Delaware	-	-	-	-	-	-
	Maryland	-	23.2	D	-	14.1	-
	District of Col.	-	-	-	-	-	-
GREAT LAKES:	Michigan	10.4	13.7	-	27.0	137.6	88.4
	Ohio	13.3	33.8	13.4	28.6	75.8	99.2
	Indiana	66.7	70.7	16.2	20.2	232.6	96.5
	Illinois	11.7	4.4	7.9	28.1	168.8	53.3
	Wisconsin	22.8	D	-	48.5	122.0	94.7
PLAINS:	Minnesota	19.2	-	-	-	166.7	-
	Iowa	-	D	-	-	90.9	-
	Missouri	-	D	D	27.4	266.7	414.3
	North Dakota	-	-	-	-	D	-
	South Dakota	-	-	-	-	-	-
	Nebraska	-	D	-	-	4.3	-
	Kansas	-	11.0	D	-	-	333.3

Table 5 (Cont'd.)

		Paper Products	Chemical Products	Petroleum and Coal Products	Primary Metals	Fabricated Metals	Transportation Equipment
SOUTHEAST:	Virginia	10.6	22.4	-	36.7	-	-
	West Virginia	166.7	8.5	D	17.4	D	-
	Kentucky	17.0	9.2	-	17.0	51.7	-
	Tennessee	6.3	6.7	-	39.8	67.3	30.6
	North Carolina	15.4	28.2	-	27.6	333.3	-
	South Carolina	9.5	27.6	111.1	-	D	-
	Georgia	4.5	22.4	500.0	D	190.5	142.9
	Florida	7.8	30.9	-	D	-	D
	Alabama	D	58.8	D	126.3	14.3	142.9
	Mississippi	-	D	-	-	-	-
	Louisiana	D	9.7	22.9	D	-	-
	Arkansas	8.5	D	-	D	1,000.0	D
SOUTHWEST:	Oklahoma	-	64.7	D	D	166.7	D
	Texas	9.3	16.8	16.1	29.1	93.8	160.0
	New Mexico	-	-	-	-	-	-
	Arizona	-	-	-	9.4	1,000.0	-
ROCKY MOUNTAIN:	Montana	-	-	-	-	-	-
	Idaho	-	-	-	-	-	-
	Wyoming	-	36.8	-	-	-	-
	Colorado	-	-	-	D	-	-
	Utah	-	-	-	-	-	-
FAR WEST:	Washington	D	D	-	D	-	714.3
	Oregon	58.9	D	27.0	-	107.1	-
	Nevada	-	D	-	-	-	-
	California	16.4	30.5	20.5	28.5	159.1	175.7
	Alaska	-	-	-	-	-	-
	Hawaii	-	-	-	-	-	-

Source: See Table 1.
D denotes data withheld by Census to avoid disclosure.
- denotes zero or insignificant amounts.

Table 6

ANNUAL COSTS PER UNIT OF POLLUTANT REMOVED, BY STATE AND INDUSTRY: 1974
AIR POLLUTION ABATEMENT
(Dollars per Short Ton)

		Paper Products	Chemical Products	Petroleum and Coal Products	Primary Metals	Fabricated Metals	Transportation Equipment
United States		16.8	35.0	14.6	31.7	137.7	71.1
NEW ENGLAND:	Maine	D	-	3.3	-	-	-
	New Hampshire	-	-	-	-	-	D
	Vermont	-	-	-	-	D	-
	Massachusetts	250.0	105.5	-	142.9	436.4	2,000.0
	Rhode Island	-	-	333.3	90.9	-	-
	Connecticut	D	180.6	-	333.3	176.5	363.6
MIDEAST:	New York	6.6	32.4	-	17.0	37.4	28.4
	New Jersey	100.0	103.7	20.4	78.2	178.6	D
	Pennsylvania	48.0	48.1	28.4	32.8	82.6	30.7
	Delaware	-	D	-	-	-	-
	Maryland	-	84.4	D	-	32.3	-
	District of Col.	-	-	-	-	-	-
GREAT LAKES:	Michigan	7.6	43.4	D	D	168.8	44.2
	Ohio	58.7	42.4	21.4	26.5	217.9	130.9
	Indiana	62.4	68.9	D	28.6	422.2	77.3
	Illinois	22.8	93.0	7.4	34.0	203.9	94.9
	Wisconsin	23.4	280.0	D	58.3	86.0	63.5
PLAINS:	Minnesota	D	-	-	D	D	D
	Iowa	D	48.1	-	D	87.5	-
	Missouri	-	69.2	D	23.2	103.4	383.6
	North Dakota	-	-	D	-	-	-
	South Dakota	-	-	-	-	-	-
	Nebraska	-	D	-	-	D	-
	Kansas	-	50.8	D	1,000.0	-	71.4

Table 6 (Cont'd.)

		Paper Products	Chemical Products	Petroleum and Coal Products	Primary Metals	Fabricated Metals	Transportation Equipment
SOUTHEAST:	Virginia	18.0	D	-	6.5	333.3	D
	West Virginia	D	14.0	D	16.3	D	-
	Kentucky	18.3	D	-	43.1	37.6	D
	Tennessee	13.4	17.3	-	42.5	121.5	52.6
	North Carolina	15.9	30.6	-	D	83.3	-
	South Carolina	9.9	42.7	3.3	-	D	-
	Georgia	7.6	31.0	333.3	D	-	142.9
	Florida	44.2	22.8	-	D	250.0	D
	Alabama	8.6	82.0	D	58.5	D	52.6
	Mississippi	-	D	-	-	D	-
	Louisiana	14.4	19.7	6.9	D	-	113.0
	Arkansas	D	14.6	-	D	1,000.0	-
SOUTHWEST:	Oklahoma	D	11.3	22.8	D	-	D
	Texas	9.2	32.2	16.5	30.7	62.5	133.3
	New Mexico	-	-	-	-	-	-
	Arizona	-	-	6.3	D	1,000.0	-
ROCKY MOUNTAIN:	Montana	-	-	-	-	-	-
	Idaho	-	D	-	-	-	-
	Wyoming	-	76.9	-	-	-	-
	Colorado	-	-	-	D	76.9	D
	Utah	-	D	-	-	-	-
FAR WEST:	Washington	21.5	32.5	D	109.1	-	D
	Oregon	80.6	D	27.0	97.0	D	-
	Nevada	-	31.3	-	-	-	-
	California	12.0	49.1	26.7	44.4	278.8	378.9
	Alaska	-	1.6	D	-	-	-
	Hawaii	-	-	-	-	-	-

Source: See Table 1.
D denotes data withheld by Census to avoid disclosure.
- denotes zero or insignificant amounts.

Table 7

ANNUAL COSTS PER UNIT OF POLLUTANT REMOVED, BY STATE AND INDUSTRY: 1973
SOLID WASTE COLLECTION AND DISPOSAL
(Dollars per Short Ton)

		Paper Products	Chemical Products	Petroleum and Coal Products	Primary Metals	Fabricated Metals	Transportation Equipment
United States		6.3	6.3	12.0	2.2	12.8	11.4
NEW ENGLAND:	Maine	70.9	-	-	-	-	-
	New Hampshire	-	38.5	-	6.1	-	40.0
	Vermont	-	-	-	-	-	-
	Massachusetts	13.8	10.7	-	4.0	19.7	-
	Rhode Island	39.2	-	-	3.3	-	-
	Connecticut	7.4	10.5	-	7.0	14.9	7.6
MIDEAST:	New York	11.6	26.0	-	3.4	7.2	3.7
	New Jersey	8.0	13.1	11.0	14.8	31.4	9.5
	Pennsylvania	6.8	15.2	10.2	4.5	14.6	29.9
	Delaware	-	-	-	-	-	-
	Maryland	-	33.7	D	-	17.4	-
	District of Col.	-	-	-	-	-	-
GREAT LAKES:	Michigan	10.9	9.9	-	1.9	9.5	17.4
	Ohio	4.0	11.3	12.0	1.0	13.4	18.1
	Indiana	17.5	11.6	7.9	2.0	19.7	10.3
	Illinois	30.3	124.3	12.8	1.9	11.8	12.5
	Wisconsin	5.0	D	-	4.2	9.6	9.4
PLAINS:	Minnesota	3.2	-	-	-	26.5	-
	Iowa	-	23.1	-	-	8.9	-
	Missouri	16.7	10.0	D	1.9	19.5	9.7
	North Dakota	-	-	-	-	-	-
	South Dakota	-	-	-	-	-	-
	Nebraska	-	D	-	-	D	-
	Kansas	36.0	24.2	D	-	-	19.6

Table 7 (Cont'd.)

		Paper Products	Chemical Products	Petroleum and Coal Products	Primary Metals	Fabricated Metals	Transportation Equipment
SOUTHEAST:	Virginia	4.9	7.2	-	3.4	-	-
	West Virginia	-	9.9	D	2.4	D	-
	Kentucky	3.9	8.1	-	4.5	11.6	-
	Tennessee	7.3	6.0	11.2	1.5	14.5	13.3
	North Carolina	3.4	3.9	-	13.3	23.3	-
	South Carolina	9.3	14.1	-	-	D	-
	Georgia	8.8	6.2	5.4	D	16.3	12.3
	Florida	3.4	2.4	6.5	D	22.7	10.5
	Alabama	5.9	9.4	D	2.8	4.5	51.7
	Mississippi	-	1.8	-	-	-	-
	Louisiana	5.2	9.4	33.7	D	19.2	4.2
	Arkansas	2.3	32.5	-	13.3	10.3	D
SOUTHWEST:	Oklahoma	-	-	16.9	D	38.5	D
	Texas	8.5	3.0	14.4	3.8	19.1	13.2
	New Mexico	-	-	-	-	-	-
	Arizona	-	-	-	2.4	-	-
ROCKY MOUNTAIN:	Montana	-	-	-	-	-	-
	Idaho	-	-	-	-	-	111.1
	Wyoming	-	1.5	-	-	-	-
	Colorado	-	-	-	D	-	-
	Utah	-	-	-	-	-	-
FAR WEST:	Washington	8.3	D	-	12.2	100.0	10.0
	Oregon	10.3	D	-	-	-	-
	Nevada	-	D	-	-	-	-
	California	11.6	17.4	14.1	1.5	21.3	4.6
	Alaska	-	D	-	-	-	-
	Hawaii	-	-	-	-	-	-

Source: See Table 1.
D denotes data withheld by Census to avoid disclosure.
- denotes zero or insignificant amounts.

Table 8

ANNUAL COSTS PER UNIT OF POLLUTANT REMOVED, BY STATE AND INDUSTRY: 1974
SOLID WASTE COLLECTION AND DISPOSAL
(Dollars per Short Ton)

		Paper Products	Chemical Products	Petroleum and Coal Products	Primary Metals	Fabricated Metals	Transportation Equipment
United States		6.3	2.7	11.9	1.7	14.4	12.0
NEW ENGLAND:	Maine	6.1	1.0	-	-	-	-
	New Hampshire	-	76.9	-	4.9	10.9	D
	Vermont	D	-	-	-	D	-
	Massachusetts	20.3	18.7	-	5.8	17.7	18.1
	Rhode Island	22.0	-	-	5.2	-	-
	Connecticut	9.9	13.0	-	6.6	2.0	8.8
MIDEAST:	New York	7.7	6.9	-	4.0	10.0	5.0
	New Jersey	7.7	15.9	11.5	19.5	27.3	9.8
	Pennsylvania	6.5	13.2	8.2	1.3	10.8	27.3
	Delaware	-	13.6	-	-	-	-
	Maryland	-	17.9	D	-	27.8	-
	District of Col.	-	-	-	-	-	-
GREAT LAKES:	Michigan	7.3	8.5	D	1.6	12.8	9.3
	Ohio	4.7	12.5	8.1	1.2	17.3	21.2
	Indiana	17.3	11.7	D	1.4	19.8	9.7
	Illinois	9.7	23.1	18.0	2.1	16.2	26.0
	Wisconsin	5.3	30.1	D	3.8	6.8	10.3
PLAINS:	Minnesota	6.9	-	-	D	16.4	D
	Iowa	D	0.7	-	D	8.0	11.6
	Missouri	16.0	15.5	D	3.8	29.4	16.0
	North Dakota	-	-	D	-	-	-
	South Dakota	-	-	-	-	-	142.9
	Nebraska	32.3	D	-	-	D	-
	Kansas	42.6	26.7	D	-	27.0	21.2

Table 8 (Cont'd.)

		Paper Products	Chemical Products	Petroleum and Coal Products	Primary Metals	Fabricated Metals	Transportation Equipment
SOUTHEAST:	Virginia	4.6	8.2	-	2.8	20.1	9.2
	West Virginia	-	11.6	D	2.8	D	-
	Kentucky	4.1	12.9	-	4.6	4.5	D
	Tennessee	6.0	6.7	14.2	0.5	17.1	26.0
	North Carolina	3.2	12.8	-	D	11.8	-
	South Carolina	6.3	9.0	-	-	D	-
	Georgia	3.2	5.3	7.5	D	13.6	18.1
	Florida	4.0	0.4	15.2	D	24.9	3.6
	Alabama	5.1	1.9	D	4.8	14.9	28.6
	Mississippi	-	1.8	-	-	D	-
	Louisiana	6.8	2.9	18.4	D	6.2	6.8
	Arkansas	D	0.4	-	6.3	27.4	D
SOUTHWEST:	Oklahoma	D	1.7	7.5	D	40.0	D
	Texas	38.3	2.8	14.6	5.0	24.1	19.3
	New Mexico	-	-	-	-	-	-
	Arizona	-	D	-	0.4	-	-
ROCKY MOUNTAIN:	Montana	-	-	-	-	-	-
	Idaho	-	D	-	-	-	37.0
	Wyoming	-	-	-	-	-	-
	Colorado	-	-	-	D	29.2	D
	Utah	-	0.2	-	-	-	-
FAR WEST:	Washington	15.7	6.9	D	11.2	83.3	11.0
	Oregon	7.3	D	-	3.5	-	-
	Nevada	-	-	-	-	-	D
	California	8.5	12.2	11.5	2.4	18.2	13.4
	Alaska	-	-	D	-	-	-
	Hawaii	-	-	-	-	-	-

Source: See Table 1.
D denotes data withheld by Census to avoid disclosure.
- denotes zero or insignificant amounts.

Table 9

Quantities of Pollutants Removed by Manufacturing Industries, by Region: 1973 and 1974
(Thousands of Short Tons)

	Air Pollution Abatement		Solid Waste Collection/Disposal		Total Air and Solid Waste	
	1973	1974	1973	1974	1973	1974
New England	293.0	289.9	1,453.4	2,414.5	1,746.4	2,704.4
Mideast	13,465.9	9,808.9	9,476.2	19,111.1	22,942.1	28,920.0
Great Lakes	14,985.7	11,747.7	26,156.2	28,898.9	41,141.9	40,646.6
Plains	4,320.9	5,006.2	3,928.8	6,441.1	8,249.7	11,447.3
Southeast	13,777.2	16,024.5	16,340.0	45,536.5	30,117.2	61,561.0
Southwest	7,215.9	6,796.1	7,232.4	13,575.2	14,448.3	20,371.3
Rocky Mountain	1,399.4	1,636.0	3,208.8	5,685.1	4,608.2	7,321.1
Far West	8,199.7	7,074.1	10,679.1	11,662.3	18,878.8	18,736.4

Source: See Table 1

Table 10

Projected Pollution Abatement Investment Expenditures by Region and Industry:

1971-1980

(Millions of 1972$)

	New England	Mideast	Great Lakes	Plains	South-east	South-west	Rocky Mountain	Far West
Manufacturing	1402.0	7296.6	8102.2	1535.7	4888.4	2688.7	424.7	3389.7
Food	57.9	308.9	343.1	196.0	251.7	83.8	40.1	200.5
Textiles	18.5	40.4	6.0	1.4	157.8	2.1	0.2	4.6
Apparel	1.3	10.6	2.1	0.9	7.7	1.5	0.1	1.8
Lumber	40.2	101.1	148.8	40.2	295.8	42.1	32.7	234.1
Paper	356.8	833.0	937.8	302.5	918.4	104.7	19.4	399.4
Printing	7.8	36.0	29.7	9.0	12.8	5.5	1.7	12.5
Chemicals	151.7	1299.3	864.9	196.8	1024.8	295.1	20.5	245.9
Petroleum	48.9	1584.7	1192.7	251.3	710.3	1645.0	144.1	1119.0
Primary Metals	207.7	1645.0	2324.2	129.1	648.5	196.5	89.9	376.1
Fab. Metals & Ordnance	93.3	202.9	375.4	66.1	129.0	63.6	20.1	135.6
Machinery except Electric	43.3	125.8	225.9	49.7	49.7	29.8	7.6	53.2
Electric Machinery	124.6	344.6	428.2	85.0	177.4	70.4	8.6	227.2
Transportation Equipment	38.1	128.7	660.7	71.2	87.9	38.0	4.4	114.0
Motor Vehicles	7.0	94.4	628.0	50.2	43.2	11.3	1.4	37.5
Other	31.1	34.3	32.7	21.0	44.7	26.7	3.0	76.5
Other Manufacturing	211.9	635.6	562.7	136.5	416.6	110.6	35.3	244.8
Nonmanufacturing	1134.8	4584.1	4117.5	1554.3	3656.4	2071.9	579.7	2390.3
Mining	11.9	119.1	146.8	80.6	407.6	369.1	99.2	84.7
Utilities	921.5	3651.8	3341.0	1227.6	2672.8	1460.7	404.0	1833.6
Transportation	24.6	149.1	112.6	50.5	109.7	42.5	14.9	82.1
Others	176.8	664.1	517.1	195.6	466.3	199.6	61.6	389.9
Total	2536.8	11880.7	12219.7	3090.0	8544.8	4760.6	1004.4	5759.0
Percent of Total	5.1	23.9	24.5	6.2	17.2	9.6	2.0	11.6

Source: Constructed from projections in Bureau of Economic Analysis, U.S. Department of Commerce, A Study of Fixed Capital Requirements of the U.S. Business Economy: 1971-1980, December, 1975.

Table 11

Regional Distribution of Environment Related Plant Closings and Job Losses

Region	Number of Plant Closings	Affected Employees number	Affected Employees percent	Number of Plants Threatened to Close	Affected Employees number	Affected Employees percent	Labor Force percent
I	4	730	4.1	1	74	0.2	6.0
II	22	5,152	28.8	0	0	0.0	9.1
III	10	1,860	10.4	7	817	2.2	14.4
IV	6	1,159	6.5	0	0	0.0	15.8
V	15	4,205	23.5	14	29,514	78.0	21.4
VI	5	1,440	8.0	1	400	1.1	9.8
VII	2	270	1.5	1	25	0.1	5.6
VIII	0	0	0.0	0	0	0.0	2.9
IX	9	1,083	6.1	7	6,401	16.9	11.7
X	9	1,991	11.1	1	600	1.6	3.3
Total	82	17,890		32	37,831		

Source: Environmental Protection Agency, 1976 Second Quarter Report of the Economic Dislocation Early Warning System; Department of Labor, Manpower Administration, "Labor Force Data for States and Major Areas, May 1975."

Table 12

ENVIRONMENTAL PROTECTION AGENCY REGIONS

Region I

Maine
New Hampshire
Vermont
Massachusetts
Rhode Island
Connecticut

Region II

New York
New Jersey
Puerto Rico
Virgin Islands

Region III

Pennsylvania
Delaware
Maryland
District of Columbia
Virginia
West Virginia

Region IV

North Carolina
South Carolina
Georgia
Florida
Alabama
Mississippi
Tennessee
Kentucky

Region V

Ohio
Michigan
Illinois
Wisconsin
Minnesota

Region VI

Louisianna
Arkansas
Oklahoma
Texas
New Mexico

Region VII

Missouri
Iowa
Kansas
Nebraska

Region VIII

Colorado
Utah
Wyoming
Montana
North Dakota
South Dakota

Region IX

California
Nevada
Arizona
Hawaii

Region X

Idaho
Washington
Oregon
Alaska

(4) A Review of Benefit Data

In light of the costs that have been and will be incurred to meet environmental, safety and health regulations, what are the benefits? The assessments of benefits are both weak and fragmentary. Benefits are undeniably more difficult to measure than costs.

In the context of environmental, safety and health regulations, benefits are the value of preservation and restoration of, and avoidance of unnecessary risks to, natural and human resources. Thus, benefits include the value of preserving the status quo where the status quo is perceived to be satisfactory and the value society places on the damages attributable to actions which degrade natural and human resources.

Most studies have measured changes in air or water pollutant emission levels or changes in ambient air or water quality. A few studies have estimated the economic cost of damages caused by air or water pollutants. These approaches to measuring benefits must be interpreted carefully. They are not all measures of benefits and are limited in their value for comparison with costs. Specifically:

--Measures of changes in emission levels are indicative only of the success of control programs to abate and control pollutants.

--Measures of changes in ambient air or water quality are physical measures of the benefits of air or water pollution abatement and control. This approach indicates whether control programs are achieving the environmental objectives. More importantly, this approach facilitates cost effectiveness comparisons between industries, regions or alternative pollution control programs.

--Measures of the economic cost of damages attributable to air or water pollutants are proxy measures of the value of benefits which would accrue if we were able to avoid the damages. Economic measures enable direct comparison of costs and benefits. There is, of course, a major set of value problems associated with the economic quantification of many classes of benefits.

Air Pollutants Abated. Compliance with the Clean Air Act (CAA) has markedly reduced the quantity of air pollutants discharged.[16] In 1970, 221.6 million tons of criteria air pollutants (particulates, sulfur oxides, carbon monoxide, hydrocarbons and nitrogen oxides) were discharged to the atmosphere. By 1974, criteria pollutant

discharges had been reduced 10.5 percent to 198.4 million tons. The overall reduction in emissions represents a 29 percent reduction in particulates, from 27.5 to 19.5 million tons; a 12 percent reduction in carbon monoxide, from 107.3 to 94.6 million tons; an 8 percent reduction in sulfur dioxide, from 34.3 to 31.4 million tons; a 5 percent reduction in hydrocarbons, from 32.1 to 30.4 million tons; a 10 percent increase in nitrogen oxides, from 20.4 to 22.5 million tons.

Mobile source emission control is an important component of these pollutant reductions. Over the period 1965 to 1975, the average per mile emissions of hydrocarbons declined 57 percent. Carbon monoxide emissions per mile declined 44 percent, while nitrogen oxides emitted per mile increased 2 percent.

The overall reductions, an average emission decline of 5.8 million tons per year, are impressive in light of the previous trends in air pollutant discharges. Over the 30 years 1940 to 1970, total emissions grew at an average of 3.3 million tons per year. Air pollution control programs are bringing about a reduction in total air pollution emissions.

Ambient Air Quality. The success of the control programs aside, the more pertinent question is, to what extent are air quality goals being achieved? As of 1975, only one-third of the 247 Air Quality Control Regions (AQCR) met ambient air quality standards for all criteria air pollutants. The standards were violated for particulates in 118 regions, for sulfur dioxide in 34 regions, for carbon monoxide in 69 regions, for oxidants in 79 regions, and for nitrogen oxides in 16 regions. These estimates may be low since many AQCR do not monitor all of the criteria pollutants.

Knowledge of ambient air quality is increasing. The network of monitoring stations is expanding. The analytic methods used are being standardized and monitoring activities are covering more pollutants. These actions will improve the measurement of changes in ambient air quality.

Increased knowledge of changes in ambient air quality will facilitate moving from estimates of physical benefits to estimates of economic benefits, especially if a single ambient air quality index is used to report air quality. Recently, a Federal task force developed and recommended for adoption by local and State pollution control agencies a new air pollution index.[187] The index was designed to reduce public

confusion and scientific inconsistency in the reporting of air quality by disparate locations. Currently, there are at least 14 different air quality indices in use. Adoption of the index is voluntary. If adopted on a widespread basis, use of the index will facilitate estimates of damages, comparisons between regions, and comparisons between control efforts.

Incidence of Air Pollutants. An Environmental Protection Agency (EPA) study provides information on the demographic and socioeconomic characteristics of populations exposed to different air pollution levels in the United States.[16] In 1973, most of the U.S. population was not exposed to short-term particulate levels, short- or long-term sulfur dioxide levels, or short-term carbon monoxide levels exceeding the Federal primary standards. However, significant proportions were exposed to long-term particulate and short-term oxidant levels exceeding the Federal standards.

Exposure by age, race, income and employment groups to different levels of pollution was in most cases very similar to that of the whole population. There was no consistent pattern across age groups. For particulates and carbon monoxide, the aged tended to be exposed slightly more than the average; for sulfur oxides, the young tended to be exposed slightly more. In terms of income groups, the poor tended to be exposed slightly more and the wealthy slightly less. In terms of occupation, manufacturing workers tended to be exposed more than other working groups.

The estimates are crude approximations because of the problems of accurately measuring pollution levels and of estimating pollution levels throughout a metropolitan area from a limited number of sampling stations. The analysis relates pollution levels to place of residence and does not take account of exposures at the workplace. If workplace exposure data were available, we would expect somewhat different results. Nevertheless, the study gives a preliminary indication of the incidence of air pollution exposure.

Future Air Quality. Recent work projects that compliance with existing air pollution standards will result in a continued improvement in ambient air quality.[41] This improvement will be due largely to the replacement of older polluting vehicles with new vehicles which meet Federal standards. Continued tightening of stationary and mobile source emission standards will add further improvement to ambient air quality.

By the year 2000, average oxidant concentrations will range from about 40 percent below the early 1970s average, if current standards are continued, and 50 percent below, if more stringent standards are applied. However, even with the stringent level of control many urban areas will not meet the hydrocarbon standard. Carbon monoxide concentrations will decrease from 75 to 85 percent depending upon the stringency of the standards. Nitrogen oxide emissions will tend to increase under all but the most stringent levels of control.

The projected improvements in ambient air quality will have health benefits. Stringent control of hydrocarbon emissions is expected to reduce persons days of chest discomfort by about 5,000 cases by the year 2000. Current carbon monoxide control levels should reduce to zero, by the year 2000, cardiac deaths and person days of discomfort attributable to carbon monoxide. More stringent carbon monoxide control would not add more health benefits. Reduction of nitrogen oxides emissions should reduce attacks of lower respiratory disease in children by about 600,000 cases per year by 2000. Control of nitrogen oxides emissions to the most stringent level would reduce such attacks by an additional 600,000 cases per year.

Ambient Water Quality. The 1974 National Water Quality Inventory found much improvement in the Nation's water and the need for considerably more improvement.[43] The pollutants receiving widespread control (coliform bacteria and oxygen demanding materials) are showing nationwide improvement. Municipal and industrial waste treatment have reduced the discharge level of harmful substances such as heavy metals and toxic chemicals. However, significant problems remain. Temperature and turbidity are problems in some Western and Southern States. High levels of phosphorous and nitrogen, an indication of eutrophication potential, are reported by most states. Acid mine drainage and high salinity levels are reported by many areas. Dissolved oxygen levels are improved in most states although almost all states report specific areas where dissolved oxygen criteria are violated. In general, nutrient parameters were the only parameters for which a significant number of states report worsening trends.

The most common water quality problems are low dissolved oxygen levels, health hazards from excessive coliform counts, and high nutrient concentrations. Despite these widespread problems, 23 of the 32 states which performed overall evaluation of their waters report that most of their waters are of good quality or already meet the 1983 goals of the Act.

The problem of high nutrient levels was confirmed by the National Eutrophication Survey. The survey found that phosphorous concentrations in 73 percent of 298 eastern lakes are high and are likely to produce symptoms of eutrophication in these lakes. The lakes are representative of the eastern half of the Nation. The data imply that eutrophication potential is increasing at a considerable rate.

Expected Water Quality. Additional improvements in water quality are expected as a consequence of municipal and industrial compliance with the requirements of the Federal Water Pollution Control Act (FWPCA). However, compliance with the FWPCA will not enable all waters to meet the goals of the Act. Forty-five states estimate that some of their waters will not meet the 1983 goal of fishable and swimmable waters. The states attribute the projected failures to: point-source discharges (30 states), non-point sources (37 states), natural conditions (21 states), and administrative problems (20 states).

Thirty states report that point-source discharges, urban stormwater runoff released through storm or combined sewer systems or through municipal and industrial discharges, will preclude attainment of fishable swimmable waters. These factors are most likely to preclude compliance in the Northeast and Great Lakes regions. Other areas of the Nation are not likely to have significant point-source compliance problems.

Non-point sources are expected to preclude compliance with the 1983 goals of the FWPCA in 37 states. The non-point sources most responsible for this prediction are:

- Agricultural activities--including soil erosion and runoff containing nutrients, pesticides and heavy metals.
- Silvicultural activities.
- Mining and acid mine drainage.
- Land development and urbanization.
- Runoff from abandoned oil fields.

Twenty-one states cite natural conditions as the reason they will not attain fishable and swimmable waters. The term "natural conditions" covers two situations. The first is where conditions not due to human activity preclude attaining fishable, swimmable waters, for example, where swampy conditions result in low dissolved oxygen or where water quality is degraded by toxic metals dissolved from rocks. This type of condition does not preclude meeting the goals of the Act in that presumably these waters have, ". . . chemical, physical, and biological integrity." The second is where natural conditions and the activities of man interact. For example, natural low water flow and discharges of pollutants combine to violate the water quality standards.

Twenty states report that the Act directly interferes with State pollution control efforts and has interrupted progress toward improving water quality. Problems common to many of the states include: permit issuance problems, missed compliance dates, inadequate data management, unrealistic permit requirements, and money.

These problems are common to many of the states. It is not clear how extensive the problems are within the particular states. A few states estimated the percentage of their waters that will not meet the fishable, swimmable waters criteria. In terms of miles of stream or number of stream segments, less than 10 percent of their waters will not meet the criteria. This finding is encouraging although not conclusive.

Economic Benefits of Pollution Abatement. National estimates of the economic cost of pollution damages have been made for air pollution in 1968 and air and water pollution in 1970 and 1973.[16] In 1968, estimates of air pollution damages range from $6 to $20 billion with the best estimate being $16 billion. In 1970, estimates of air and water pollution damages range from $7.5 to $35 billion with the best estimate being $23 billion. In 1973, estimates of air and water pollution damages range from $14 to $54 billion with the best estimate being $30 billion.

The estimates are of the total damages caused by pollution. The estimates can be viewed as a proxy measure of the benefits which would occur if we were able to stop polluting air and water and thereby avoid the damages. Damage estimates most probably represent a minimum estimate of the value of not polluting.

The National Commission on Water Quality (NCWQ) has estimated the benefits of water pollution control programs undertaken to comply with the FWPCA.[31] In the aggregate, direct benefits are estimated to increase from $3.1 to $4.2 billion per year in 1980, to $4.8 to $6.2 billion per year in 1985, and reach $6.3 to $8.5 billion per year in the year 2000. These estimates measure changes in land values and in recreational activities. They do not include potential health benefits, the monetary value of avoiding irreversible environmental damages, or the value of preserving water quality at specified levels. The benefits are distributed as follows:

- Increased values in marine fishing will result in annual economic gains of $2.4 billion in 1980, $3.9 billion in 1985, and $5.2 billion in 2000.

- Increased fresh water fishing activities will yield annual gains of from $218 to $527 million in 1980, from $220 to $558 million in 1985, and from $217 to $800 million in 2000.

- New flows of economic activity will result from the reopening of beaches. The annual values of this increased activity will range from $142 to $471 million in 1980, from $158 to $521 million in 1985, and from $212 to $701 million in 2000.

- Real estate near recreation type water bodies will experience an increase in value of $62 million in 1980 and $92.5 million annually for the period 1985 to 2000.

- Other types of boating activity will increase dramatically. The annual values of these increases range from $306 to $695 million in 1980, from $498 million to $1.2 billion in 1985 and from $528 million to $1.7 billion in 2000.

(5) A Discussion of Costs and Benefits

Government agencies responsible for regulations are sometimes given a general mandate to maximize public welfare and are then left with considerable freedom to translate the goal into concrete regulations. The result is often an ambiguity about the weight to be given to various factors in making choices and leads to decisions which are vulnerable to criticism on grounds of inconsistency or of lack of adherence to the mandate. (A discussion of the extent to which there is room for flexibility and/or ambiguity in the major pieces of environmental health and safety legislation is at pp. 34-57 above.)

In some cases, it may be conceivable that total prohibition of an action may be the best possible alternative. This may be the case if: (1) the cost of measurement is so high that only a yes-no decision is feasible, or (2) the threat of damage is so extreme that marginal reasoning underlying a cost-benefit analysis cannot be legitimately applied.

An alternative is to limit prohibition to cases of clear and present danger, and, in the meantime, to develop technology to deal with the current problem. More generally, a somewhat arbitrary standard is selected as portraying an acceptable environment. Such standards are determined from scientific research into safe levels of various agents in the environment. In some cases, research may find that a 99.9 percent standard is not needed to safeguard the health of the population and more appropriate standards should be established to lessen the economic impact of the regulation. It is essential that the costs and benefits of an agency's regulations be examined in relation to the targeted or presumed risk.

Although attempts have been made to estimate the direct costs of specific regulations to specific industries (as noted in the discussion of industrial impacts), such estimates are underestimates to the extent that the following costs are not taken into account: (1) costs of regulations taken together, (2) costs of regulations arising from the interrelationship among inputs, processes, and outputs, and (3) costs associated with longrun effects.

Further, it is evident that emissions, damages, and benefits have yet to be brought together and related to costs in a way that will permit comparisons of the benefits per dollar of expenditures on various regulations.

For example, the Council on Environmental Quality (CEQ) reports that if the controls prescribed by the 1972 Amendments to the Federal Water Pollution Control Act (FWPCA) were achieved, industrial discharges would be reduced from 4.3 billion pounds of Biological Oxygen Demand (BOD) in 1973 to 0.5 billion pounds in 1977 and 0.3 billion pounds in 1983.[17] Total Suspended Solids (TSS) would be reduced from 117.9 billion pounds in 1973 to 11.8 billion pounds in 1977 and 4.2 billion pounds in 1983. These reductions have yet to be given meaning in terms of human health, crop losses, damage to materials, reductions in land use values, or other economic measures of welfare, or to be related to the $68.5 billion in incremental costs to industry. As the CEQ recognizes: "For all pollutants, there is a need to develop more accurate descriptions of the human health risks and more sophisticated indicators that include such factors as how many persons are exposed, how individuals differ in their sensitivity, and how pollution levels vary within a region."

Aggregate Benefit-Cost Estimates:

National expenditures for pollution abatement and control in 1973 were estimated to be $23 billion. National estimates of air and water pollution damages in 1973 range from $14 to $54 billion, with a best estimate of $30 billion. Comparing the best estimates, we see that benefits were greater than costs in 1973.

It should be noted that the estimates are not directly comparable. The cost estimate is of total expenditures made by business, consumers and government for pollution abatement and control. The effect of these expenditures is to avoid a portion of pollution-caused damages. The estimate of benefits is of the total damages attributable to air and water pollutants. To gain these damage values as benefits would require a cessation of polluting activity. In short, the benefit estimates cover a broader range of benefits than resulted from the expenditures for pollution abatement and control. Consequently, in comparing the costs and benefits, the cost estimates are a low estimate of what would be necessary to gain the full range of benefits.

Over the period 1972 to 2000, using NCWQ cost estimates, a conservative estimate of the net present value of compliance with the Federal Water Pollution Control Act is $195.8 billion.[31] This estimate is low because it does not include the costs of operating municipal wastewater treatment facilities or the costs of controlling agricultural and nonpoint sources. Further, it does not account for the time phasing of the costs. For the same period, the NCWQ estimates benefits to have a net present

value of from $67.2 to $88.1 billion.* Comparing the benefits and costs, we see that the benefits are less than half of the estimated costs over the period 1972-2000. Consequently, it appears that the costs of compliance with the FWPCA over the period 1972-2000 would exceed the benefits of compliance.

The NCWQ also developed benefit estimates for the years 1980 and 1985. The NCWQ estimates that in 1983 annual costs of compliance will range from $12.6 to $13.9 billion. Bracketing this 1983 estimate with the benefit estimates for 1980 and 1985 we see that in 1980 benefits are expected to range from $3.1 to $4.2 billion per year and in 1985 to range from $4.8 to $6.2 billion per year. Consequently, on the basis of this very crude comparison it appears costs would exceed benefits in the early 1980s.

We are left with global estimates of benefits and of costs, on the one hand, and scattered estimates of costs relative to pollutant reduction, on the other hand:

- In the case of the steel industry, compliance with Best Practicable Control Technology Currently Available (BPT) (1977 FWPCA requirements)--removal of 96 percent of contaminants--will entail operating costs of $2.00 per pound and capital costs of $8.00 per pound of pollutants removed.[38] The incremental cost to achieve Best Available Technology Economically Achievable (BAT) (1983 requirements)--an additional 3.6 percent removal of contaminants--will entail operating costs of $29.00 per pound and capital costs of $118.00 per pound of pollutants removed.

  Achievement of the BPT control level will presumably improve markedly the water quality of the waterways to which the steel industry discharges effluents. The benefits of the additional 3.6 percent pollutant removal have not been determined.

- In the case of the chemical industry, the costs of water pollution abatement are expected to increase from 1.4 percent of the industry's value of production in 1974 to 2.9 percent in 1977 and to 5.0 percent in 1983.[23] The corresponding annual costs of water pollution abatement are $180 million in 1974, $407 million in 1977, and $709 million in 1983. Using 1970 as a base, the percent reductions of pollutants associated with these costs are:

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* These estimates are based on NCWQ data which considered only changes in land values and recreation values.

	1974	1977	1983
BOD_5 Biological Oxygen Demand	51	86	93
COD Chemical Oxygen Demand	43	74	88
TSS Total Suspended Solids	31	93	97

The annual cost of control per pound of pollutants (BOD, COD, TSS) removed per day in 1974 is $47, the capital requirement per pound is $124. The incremental annual cost per pound in 1977 is $52 with incremental capital requirements of $160 per pound. The incremental annual cost per pound in 1983 is $358 with incremental capital requirements of $1150 per pound. Again, the benefits associated with these costs are not known.

- The Environmental Protection Agency (EPA) has promulgated New Source Performance Standards (NSPS) for copper, lead, and zinc smelters which, in effect, will require in most instances use of double contact acid plants for control of SO_2 emissions in gas streams generated by new or modified smelters.[24] Double contact acid plants, when operating, capture slightly more SO_2 than do single contact acid plants. This increment of SO_2 recovery is attained with a very heavy energy penalty.

  For the typical smelter gas stream, the electrical power requirement for a single contact acid plant capturing approximately 97 percent of input SO_2 amount to about 125 kilowatt hours per ton of acid produced. Assuming the electrical power to be generated in a steam-electric plant burning typical Western coal, this electrical power requirement is roughly equivalent to 402 pounds of coal per ton of sulfur recovered. On the other hand, the electrical power requirement for a double contact acid plant capturing approximately 99.4 percent of input SO_2 amounts to about 175 kilowatt hours per ton of acid produced or the equivalent of 563 pounds of coal per ton of sulfur recovered. This means, then, that the coal equivalent of electrical power required to capture the increment of sulfur amounts to approximately 7100 pounds per ton--almost an eighteen-fold increase in energy resource consumption as compared to achieving 97 percent SO_2 recovery in a single contact acid plant. This is a substantial energy penalty to pay for a small increase in SO_2 recovery.

- In the case of the petroleum industry, an American Petroleum Institute (API) sponsored study by Battelle Columbus Laboratories, now nearing completion, compares the impacts of "anticipated" and "restrictive" (worst case) environmental regulations on oil industry capital investment over the ten-year period 1976-1985 as follows:[15]

	Anticipated	Restrictive	Incremental Differences
Federal Regulations	11.4	26.9	15.5
State & Local Regulations	6.5	10.7	4.2
All Regulations	17.9	37.6	19.7

Assuming that the restrictive case adds projects where incremental costs exceed marginal benefits, the oil industry may be forced to spend some $20 billion on programs with no net societal benefits. Although this incremental $20 billion may represent only 5 to 10 percent of anticipated total industry capital expenditures for the 1976-1985 period, this expenditure could be more productive in new energy development, domestic refinery expansion, development of the Outer Continental Shelf (OCS), and the like. The issue of the elasticity of the capital market aside, this $20 billion could be utilized to finance roughly: 1 MM bbls/day of shale oil development; or 4 MM bbls/day of domestic refining capacity; or 1.2 MM bbls/day (crude oil equivalent) of OCS oil and gas production. (During the past 20 years, the oil industry has spent approximately $25 billion on Federal leases in the Gulf of Mexico which are currently producing: crude plus condensate of 0.834 MM bbls/day and gas production (9.672 billion c.f./day of 0.647 MM bbls/day equivalent.)

While we are not able to compare benefits and costs directly, we can evaluate the cost impact between industries of air and water pollution abatement and solid waste disposal. The annual cost per million gallons of waste-water treated in 1973 varies widely between industries. The cost varies from $45.48 per million gallons in primary metals to $2,385.24 in fabricated metal products. For air pollutant removal, the annual cost per ton in 1974 varies from $5.74 per ton in stone clay and glass products to $173.08 per ton in miscellaneous manufacturing industries. The annual cost per ton of solid waste disposal in 1974 ranges from $1.71 per ton in primary metals industries to $25.72 per ton in instruments and related products.

From 1973 to 1974 the per unit cost of air pollutant abatement increased an average of 40 percent. The changes by individual industries range from a 5 percent decrease in petroleum to a 125 percent increase in leather and leather products. Solid waste per unit disposal cost shows a decline of 23 percent from 1973 to 1974. Solid waste disposal cost also varies widely by industry from a 57 percent decline in chemicals to a 51 percent increase in tobacco products.

The national data on unit cost of wastewater treatment do not allow inferences as to the trend of wastewater treatment costs. It is expected that the unit cost of water pollution abatement will increase overall and continue to show wide variation between industries.

For example, the figures below show for four industries differences in average annual cost and capital investment per pound of water pollutants in 1974 and the incremental annual cost and capital investment per pound in 1977 and 1983.[1]

Annual Cost

	1974	1977	1983
Copper Mining & Smelting	$0.24	$2.11	$7.87
Lead & Zinc Mining & Smelting	0.89	1.02	2.42
Other Metal Mining	5.62	0.43	1.22
Nonmetallic Mineral Mining, except Fuels	*	1.25	17.19

Capital Investment

	1974	1977	1983
Copper Mining & Smelting	$1.64	$7.17	$55.86
Lead & Zinc Mining & Smelting	3.69	3.91	15.39
Other Metal Mining	305.41	2.97	21.61
Nonmetallic Mineral Mining, except Fuels	*	5.38	51.06

In a broader context, there is a question whether our control strategies are efficient. Efficiency dictates that when controlling specific pollutants we should develop strategies which maximize the quantity of pollutants removed for a given expenditure. The preceding shows marked variations between industries in the per unit removal costs. The following implies the same between municipal, industrial and nonpoint sources of water pollutants.

In 1973, 54.9 billion pounds of BOD and 3821.8 billion pounds of TSS were discharged to the Nation's waterways.[32] These pollutants were contributed by source as follows:

*Not Available.

Pollutant Loadings 1973

	Billion Pounds		Percent of Total	
	BOD	TSS	BOD	TSS
Municipal Wastewater	5.6	5.9	10.2	0.2
Industrial Discharges	4.3	117.9	7.8	3.0
Nonpoint Sources	45.0	3698	82.0	96.8
Total	54.9	3821.8		

If all municipal wastewater is controlled to the secondary treatment level, discharges will be reduced to 2.6 billion pounds of BOD and 3.0 billion pounds of TSS. Control of industrial discharges to the BPT level will reduce industrial discharges of BOD to 0.5 billion pounds and TSS discharges to 11.8 billion pounds. Control of industrial discharges to the BAT level will reduce industrial discharges to 0.3 billion pounds of BOD and 4.2 billion pounds of TSS.

The contribution of nonpoint sources could be reduced by 50 percent. If urban runoff is controlled by stormwater collection, storage and treatment at municipal treatment works, nonpoint source contributions would be reduced for BOD from 45.0 to 22.9 billion pounds and for TSS from 3698 to 1866 billion pounds. Thus, after institution of controls (industrial discharges controlled to the BPT level) the quantities and distributions of pollutants are as follows:

Pollutant Loadings After Control

	Billion Pounds		Percent by Source	
	BOD	TSS	BOD	TSS
Municipal Wastewater	2.6	3.0	10	0.16
Industrial Discharges	0.5	11.8	2	0.63
Nonpoint Sources	22.9	1866	88	99.21
Total	26.0	1880.8		

On a combined basis, BOD and TSS loadings in 1973 and after control are:

	1973 Loadings		Loading After Control	
	Billion Pounds	Percent	Billion Pounds	Percent
Municipal Wastewater	11.5	0.3	5.6	0.3
Industrial Discharges	122.2	3.2	12.3	0.6
Nonpoint Sources	3743.0	96.5	1888.9	99.1
	3876.7		1906.8	

As can be seen, nonpoint sources are by far the largest contributor of BOD and TSS pollutants. To date, water pollution abatement strategies have focused on abating municipal wastewater and industrial discharges. There is a question whether this is the most efficacious strategy.

Calculating the capital requirements per pound of combined pollutant removal, we find that there is wide variation in the cost of abatement between sources.

Capital Requirements Per Pound of Combined Pollutant Removed [31,32]

	Capital (Billions $)	Pollutants Removed (Billions of Pounds)	$ Capital per pound
Municipal Wastewater	10.8	5.9	1.83
Industrial - BPT	36.0	109.9	0.33
Incremental BPT to BAT	23.0	7.8	2.98
Industrial - BAT	59.0	117.7	0.50
Nonpoint Sources	305.0	1854.1	0.16

The estimates of capital required per pound of combined pollutant removed are rough estimates of the cost effectiveness of the assumed control levels. It should be noted that these calculations assume away many complexities. Control of the common pollutants BOD and TSS is at best crudely indicative of water cleanup. There are other common pollutants and toxic pollutants. The control technologies underlying the above calculations remove some of these other pollutants. Consequently, the cost effectiveness comparisons do

contain biases. As rough estimates of cost effectiveness, these estimates imply that we should review our control strategies. It appears that the quantity of pollutants removed can be substantially increased without an increase in expenditures by a reallocation of expenditures between sources.

(6) Summary and Exhibits

The foregoing review of available data would support the following general observations as to current evidence.

--As noted, data remains highly inadequate; although it is improving, there is clearly a need for major additional improvement.

--Costs of regulation are clearly major.

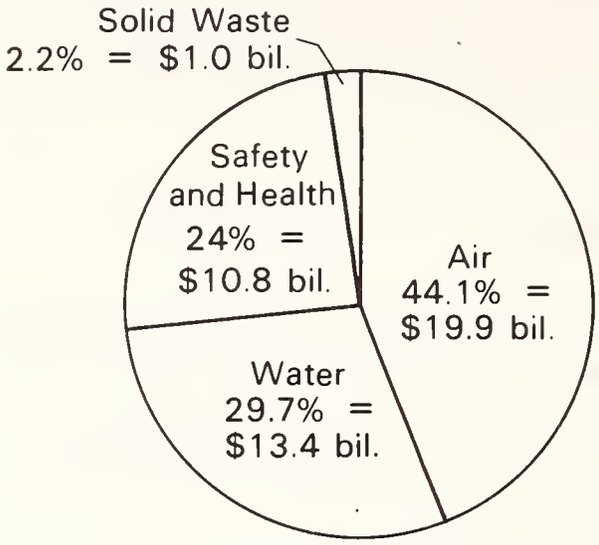
--In some cases, benefits clearly outweigh costs; in others, the benefits are uncertain and/or the relationship to costs would be favorable only with very high assessment of "non-economic" benefits.

--The impact of regulation varies very considerably by industry and by region. Regional analysis is at a particularly early stage of development--and there is little evidence of its having been systematically considered in the framing of regulatory policy.

--The incremental cost of specific regulations, beyond a point, appears to increase dramatically with respect to benefits. There is little evidence of a rational regulatory strategy in this respect--i.e., focusing incremental demands for limited resources on standards, or industries, or sectors, or regions in a manner which would optimize the aggregate level of benefits achieved, given what are limited total resources with which to pursue benefits.

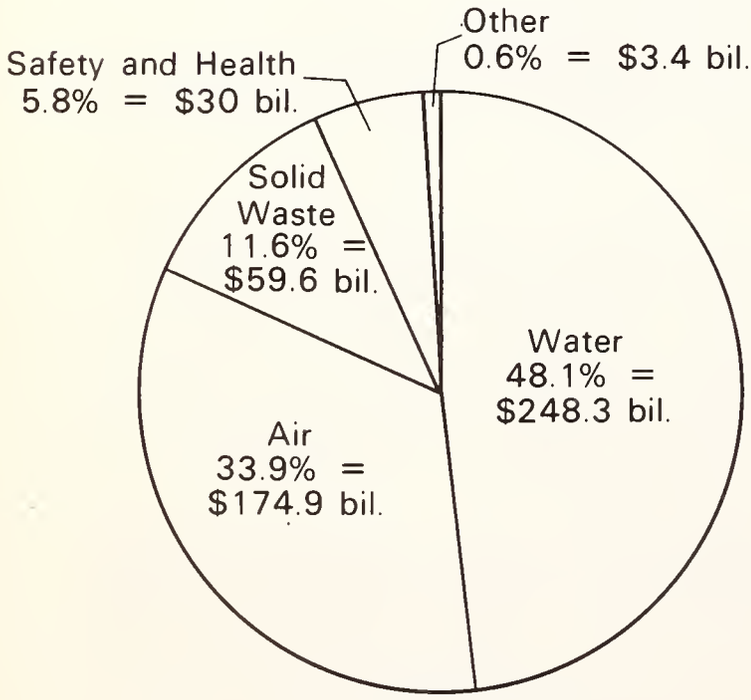
The exhibits which follow summarize selected data identified in the foregoing discussion.

Cumulative Business Expenditures To Achieve Environmental, Safety and Health Objectives, 1964 Through 1975

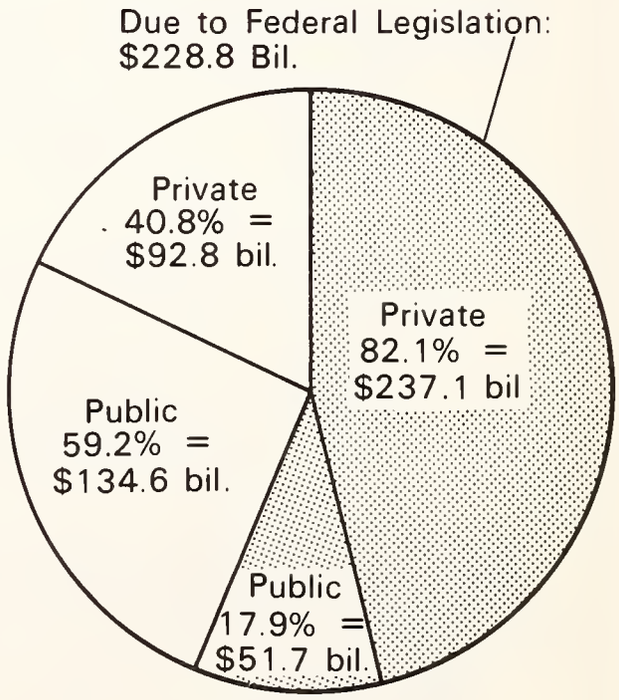


Total: $45.1 Billion

Projected National Expenditures to Achieve Environmental, Safety and Health Objectives, 1975 Through 1984



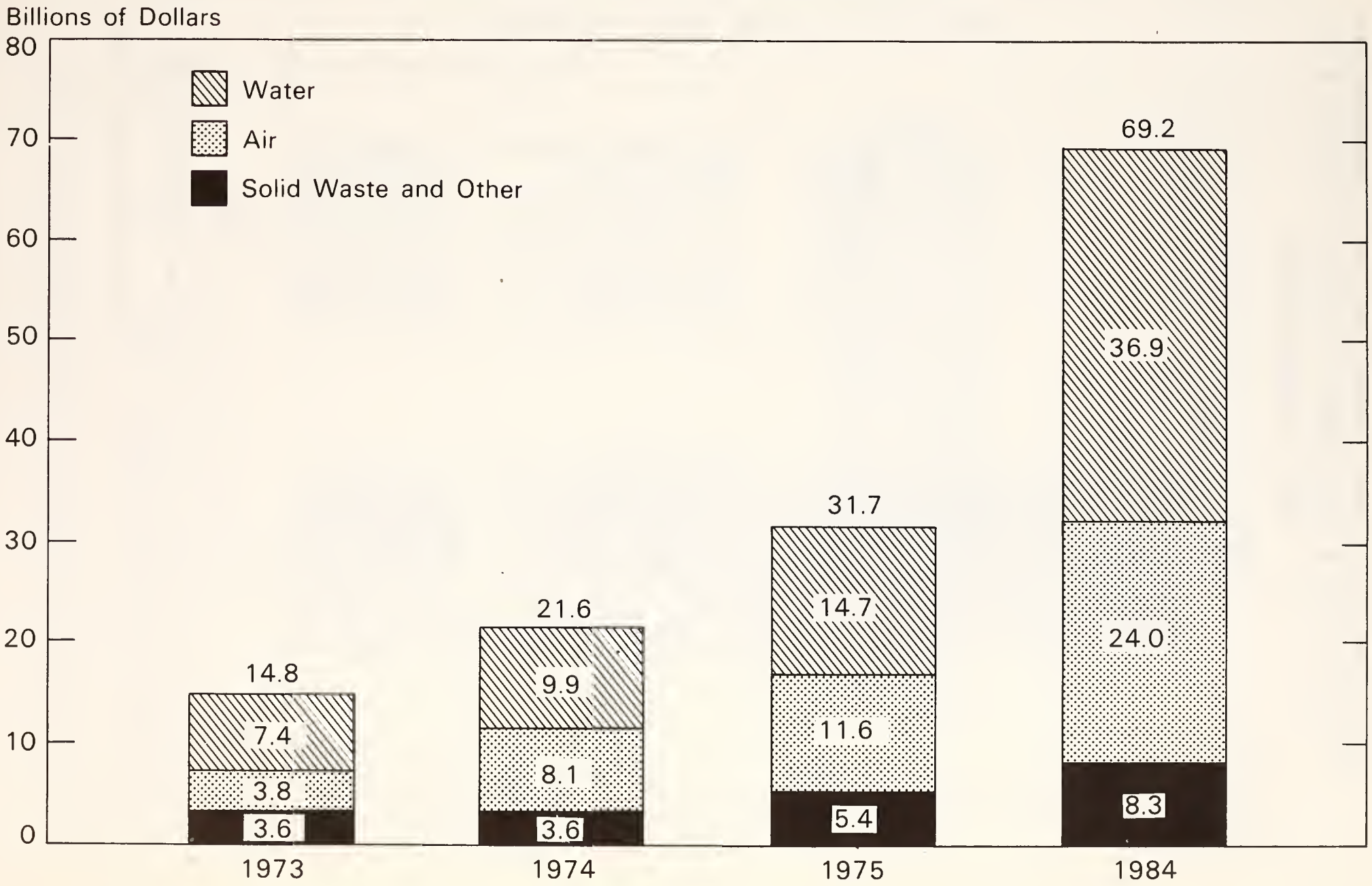
Total: $516.2 Billion



Total: $516.2 Billion

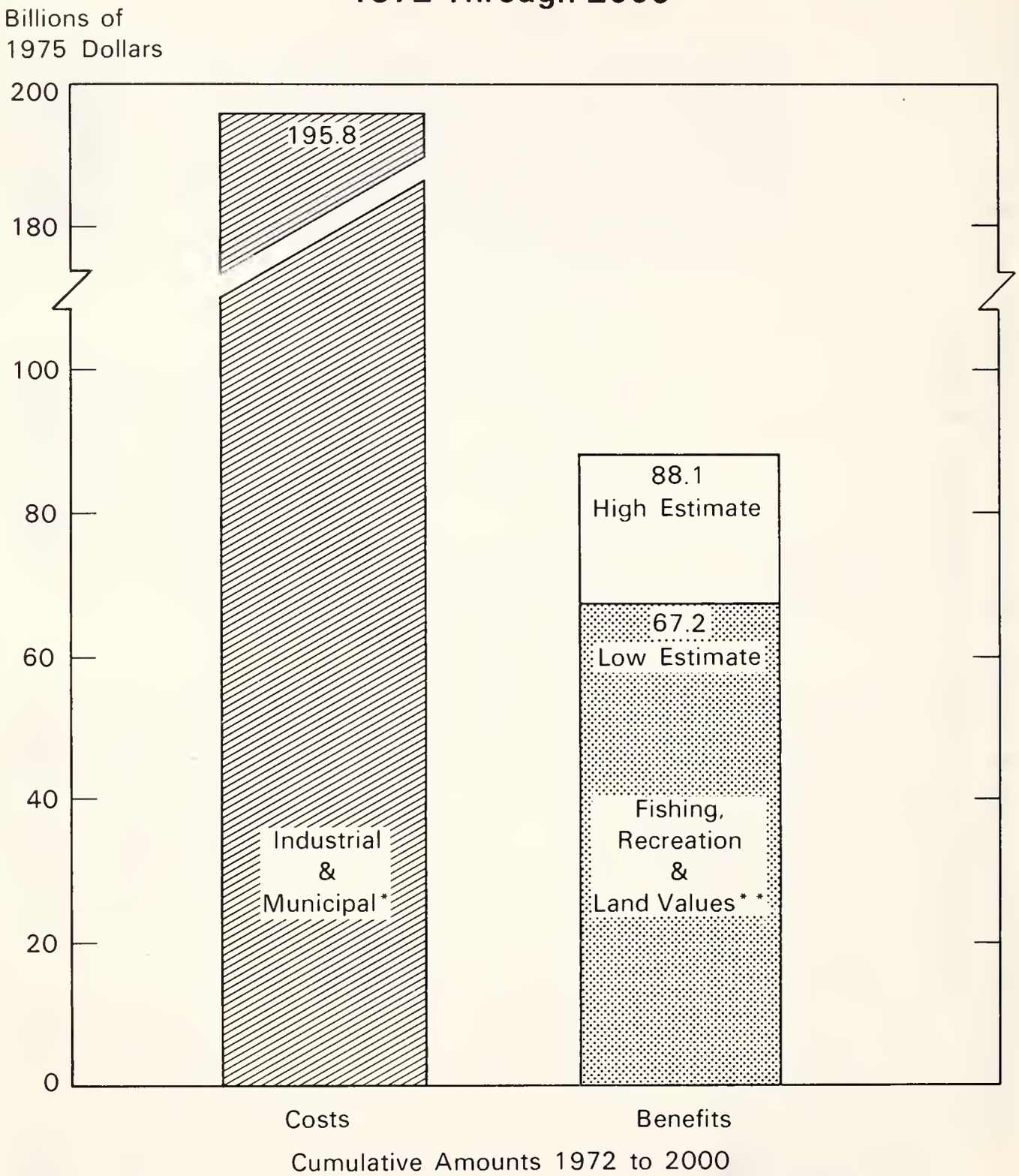
Source: CEQ 7th Annual Report; McGraw-Hill Publications Co. series on expenditures for employee safety and health and pollution control; DOC projections of expenditures for employee safety and health.

Actual and Projected Total National Expenditures for Pollution Control for Selected Years



Source: Council on Environmental Quality, 5th, 6th, and 7th Annual Reports.

Estimates of the Net Present Value of Benefits and Costs of the Federal Water Pollution Control Act, 1972 Through 2000

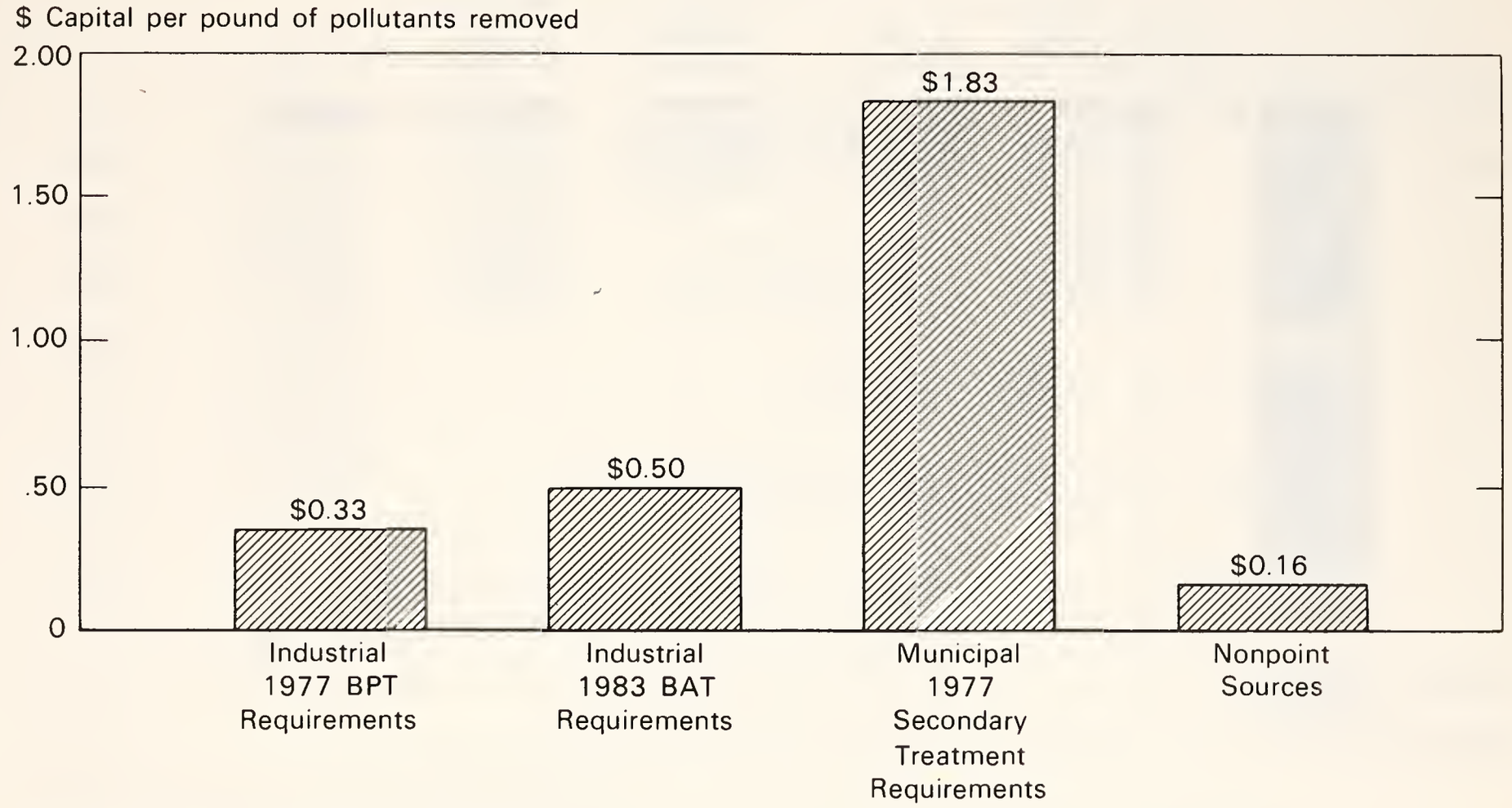


*Does not include the cost of operating municipal wastewater treatment facilities or the cost of controlling agricultural and nonpoint sources.

**Does not include the value of abatement of human health hazards and of some nonuse related benefits.

Source: Staff Report to the National Commission on Water Quality, April 1976.

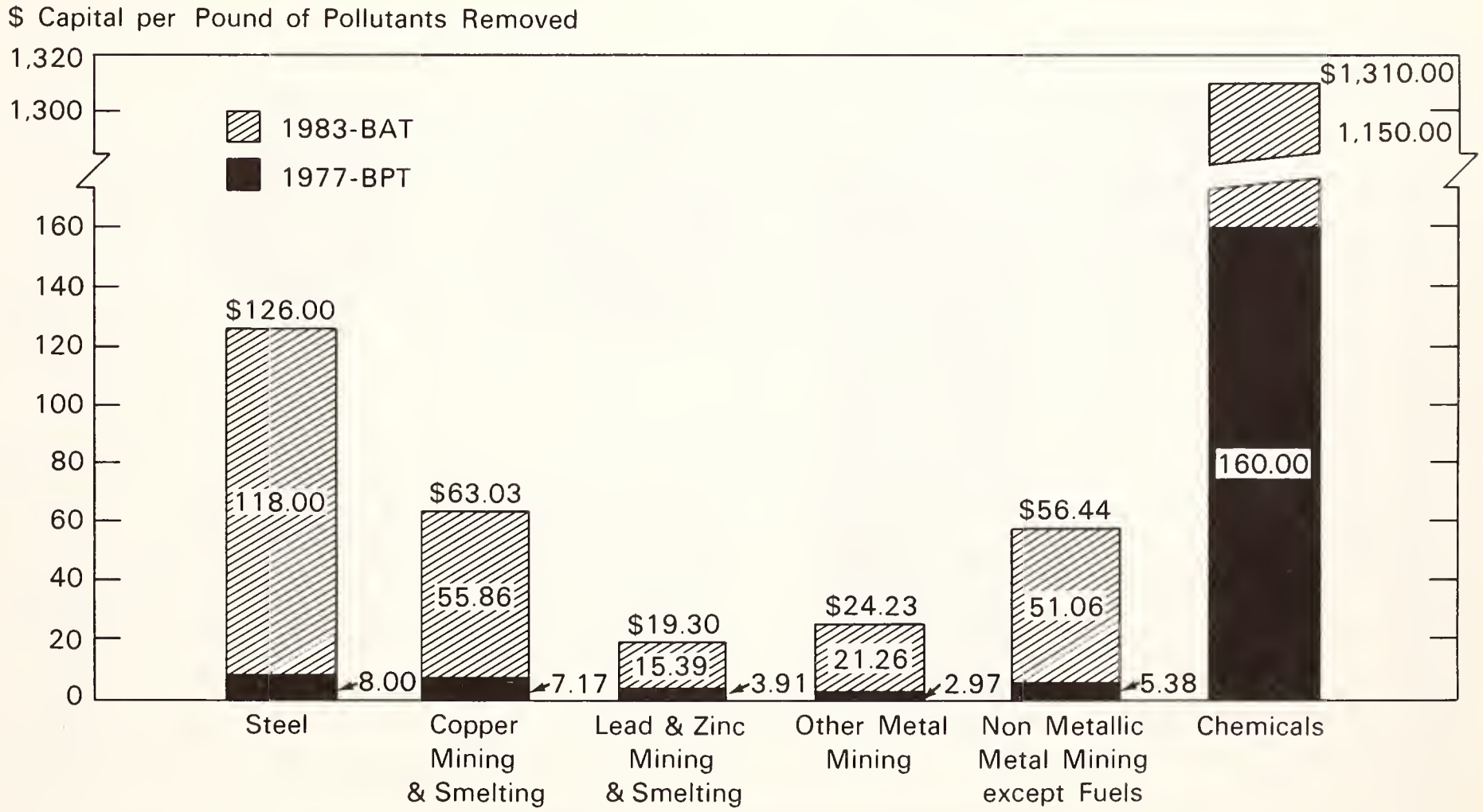
Capital Expenditures for Water Pollution Control per Pound of Combined Water Pollutants by Industrial Point Source Dischargers, Municipal Wastewater Treatment and Nonpoint Sources*



*Based on treatment capabilities in existence in 1974

Source: Calculated from data reported in *Water Pollution Control Act of 1972: National Residuals Discharge Inventory,* National Research Council, January 1975; and *Staff Report to the National Commission on Water Quality,* April 1976.

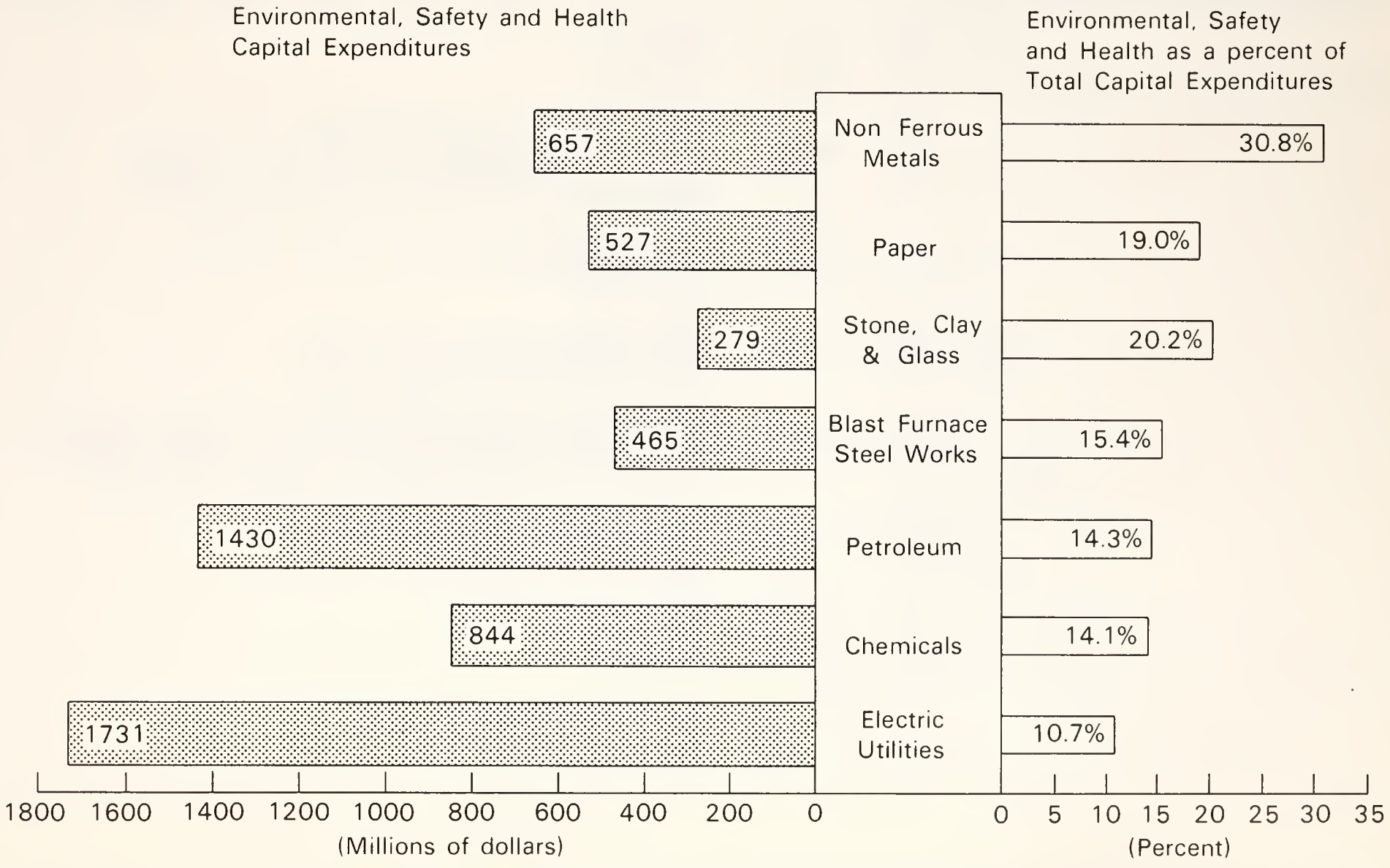
Capital Expenditures per Pound of Combined Water Pollutants to meet 1977-BPT and 1983-BAT Requirements of the Federal Water Pollution Control Act, by Selected Industries*



*Based on treatment capabilities in existance in 1974.

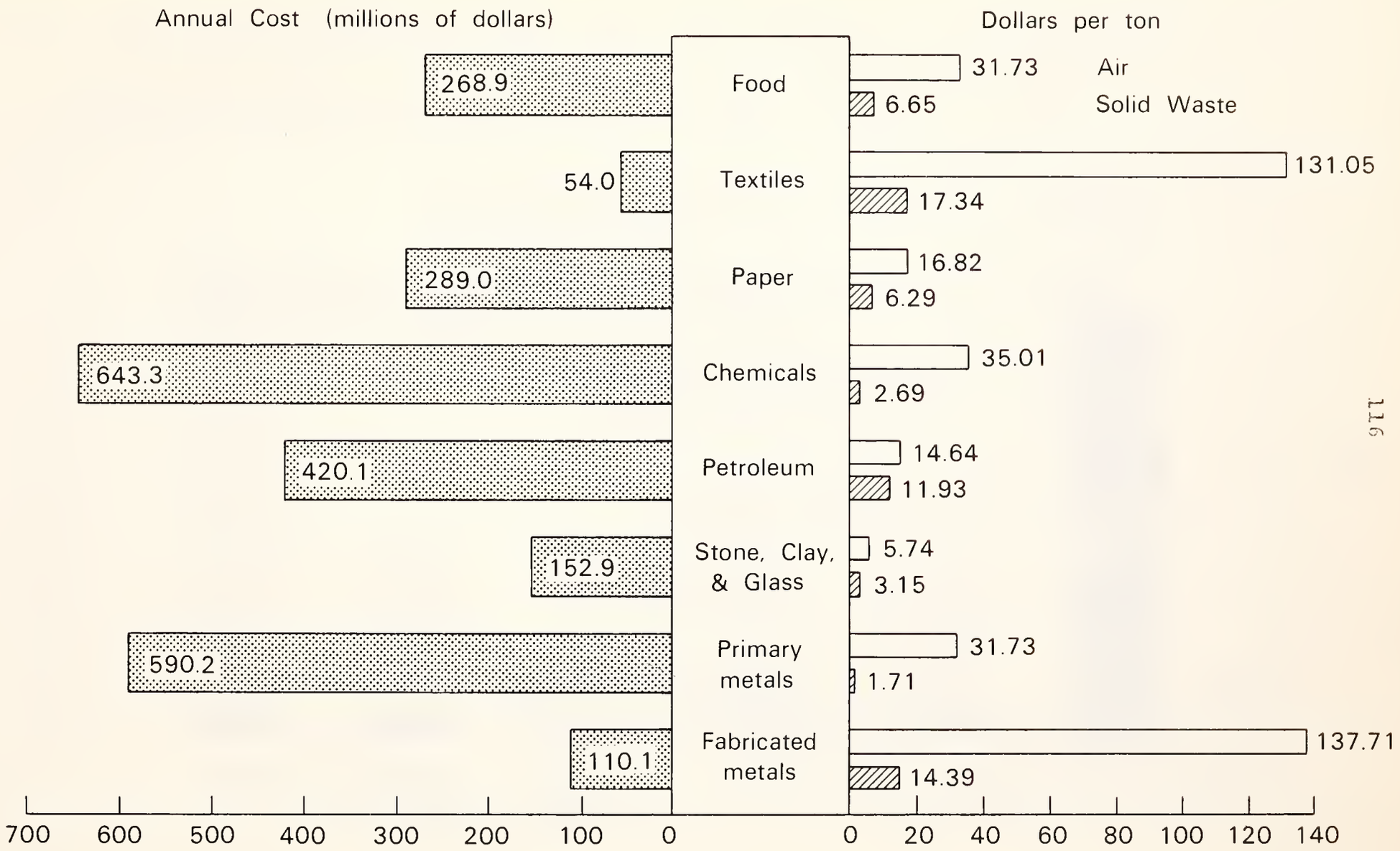
Source: Study by the American Bureau of Metal Statistics and presentation at the Business Roundtable Briefing Session, January 29, 1976.

Environmental, Safety and Health Capital Expenditures by Selected Industries: 1975



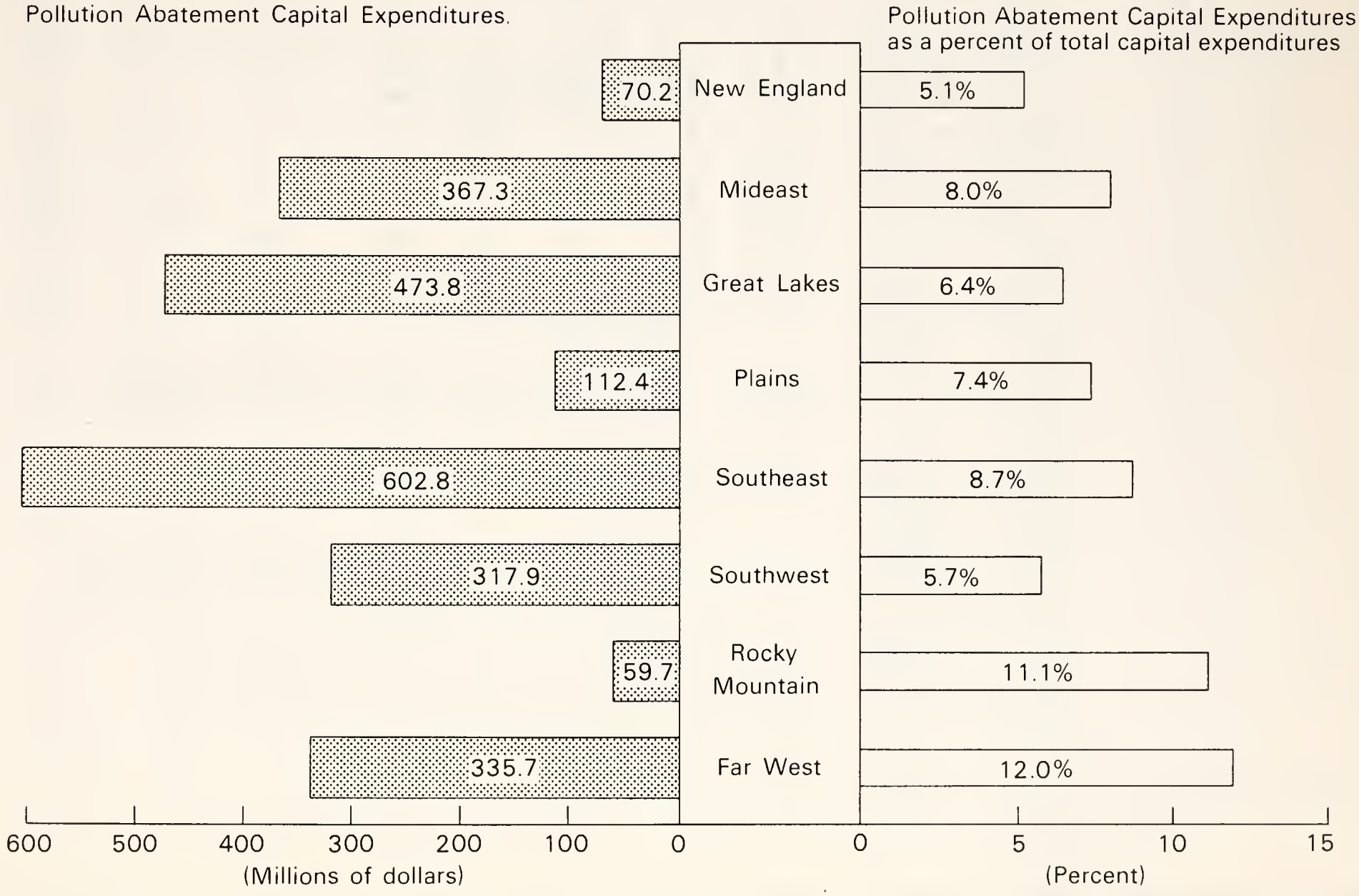
Source: Bureau of Economic Analysis, U.S. Department of Commerce and McGraw-Hill Publications Co.

Annual Cost of Selected Manufacturing Industries for Pollution Abatement and Annual Cost per ton of Air Pollutants Abated and Solid Waste Disposed: 1974



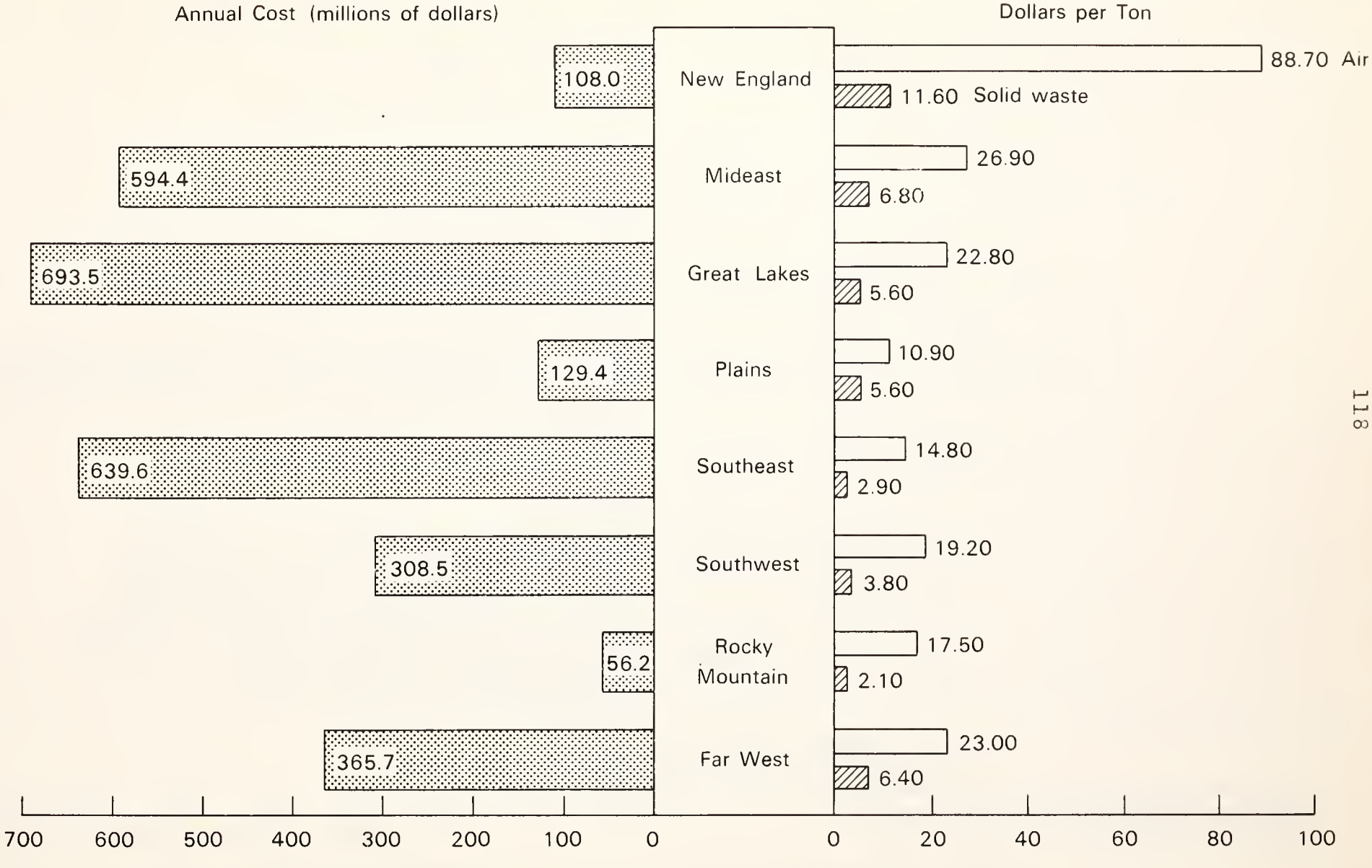
Source: Calculated from data reported in Bureau of the Census, U.S. Department of Commerce, *Pollution Abatement Costs and Expenditures, 1974.*

Pollution Abatement Capital Expenditures by Manufacturing Industries, by Region: 1973



Source: Calculated from data reported in Bureau of the Census, U.S. Department of Commerce, *Pollution Abatement Costs and Expenditures, 1973.*

Annual Cost of Manufacturing Industries for Pollution Abatement and Annual Cost per ton of Air Pollutant Abatement and Solid Waste Disposal, by Region: 1974



Source: Calculated from data reported in Bureau of the Census, U.S. Department of Commerce, *Pollution Abatement Costs and Expenditures, 1974.*

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C. DIRECTIONS FOR CHANGE: FASHIONING A BALANCED FUTURE

As noted in the Introduction, this paper focuses on the need for an improved regulatory policy system--to expose more fully relevant issues, interrelationships and facts; to represent more fairly competing general interests; and to determine more satisfactorily the preferred balance for their resolution. That is, the paper, and this discussion of directions for change, is concerned primarily with the issues of process which determine the substantive character of regulations, rather than with individual regulations themselves.

Part (A), above, has suggested the importance of environmental, health and safety regulation not only to the environment, health and safety, and not only to patterns of economic performance and development--but also to general concerns with the growing "bigness", remoteness and unresponsiveness of government and with the associated sense of citizens' alienation. Part (B) has pointed first to certain legislatively determined inflexibilities in the current regulatory system--and to their possible contribution to a degree of "regulatory unreasonableness." It has then reviewed available empirical evidence which may be viewed as suggesting that the possibility of unreasonableness has become a reality--that economic considerations seem, to some extent, underrepresented in the formulation of regulatory policy generally; that the current system may be irrationally inflexible to differences in the regional impacts of regulation; that the dramatic increases in the incremental costs of increasingly stringent regulation may not, in some cases, be properly balanced in relation to benefits or in relation to alternative possible applications of limited resources.

In this part, general directions for change are outlined with a view toward their contribution to greater "regulatory reasonableness."

A caveat which is clearly evident from all of the above must be: that this entire subject requires serious additional study and analysis. The major increase in the scope and degree of federal regulatory intervention is, as noted, a recently emergent phenomenon. As in the case of other recently emergent areas of dramatically expanded federal activity, it should not be surprising that first approaches might have proved over-optimistic, or too simplistic, and in need of additional analysis and some correction. That is the view here; but it is important to emphasize that the directions for change are indeed intended as "corrections" and not as radical reforms or retreats.

Before turning to the main areas of recommended further analysis and correction, two additional introductory observations are in order:

- First, policy development in the area of environmental, health and safety regulation would benefit considerably from improved general education as to the full nature of the often-competing stakes which are involved--and the complexities inherent in their analysis and in the formulation of reasonably balanced approaches to "solutions." As a practical matter, there is probably relatively little that can be done about this. Papers such as this one may make some contribution to a narrow audience. But more general education will depend primarily on the exposure of relevant facts in response to the dictates of objective reality, the economic marketplace and the marketplace of ideas.

- Second, policy development in this area would benefit considerably from a general cooling of temperatures with respect to what too often becomes highly emotion-laden argument. To this end it would be useful if highly irritating minor absurdities--the regulation of approaches to the climbing of a step ladder or preposterous and avoidable administrative delays--could be recognized and treated as such, without confounding the analysis and treatment of major regulatory policy issues. Here work of the Commission on Federal Paperwork, the ongoing OSHA review of the national consensus standards, the regulatory agency administrative process reforms recently fostered by the Domestic Council Regulatory Group and the Council of Economic Advisers--all such should help improve the reasonableness of major regulatory policy debate by reducing the general level of avoidable irritation. In any case, a distinction must clearly be made between issues of avoidable irritation and issues of fundamental and competing national interests. It would be helpful, further, if--as argued in the introduction--these interests could be perceived as competing general interests, and not as the overly simplified opposition of "public" and "private" interests. But this presumably will depend upon the process of education touched on above.

The principal directions for change on which, this paper would argue, further attention should be focused are as follows:

Increasing the Recognition of Economic Reality and Relevance in the Regulatory Process

The three principal environmental, health and safety laws, the Clean Air Act, the Federal Water Pollution Control Act, and the Occupational Safety and Health Act, contain inflexibilities which preclude sufficient consideration of the economic costs of the regulatory schemes they provide.

The Clean Air Act commands establishment of national air quality standards, to protect the public health and welfare, without regard to their technological or economic feasibility. It requires regulation of hazardous pollutant emissions to a level which provides an "ample margin of safety," regardless of the cost or technological feasibility of accomplishment. It calls for "no significant deterioration" of the ambient air, without regard for the social and economic inflexibilities that must attend such a mandate. It prescribes automotive emissions limits which have proved technologically infeasible.

The Federal Water Pollution Control Act declares a national goal of "zero discharge" by 1985 by means of technologically-based interim goals in the design of which cost is a relevant factor. However, it does not allow consideration of the costs of application of these technological standards to individual industrial facilities. Further, it creates an inflexible presumption that costs incurred for effluent reduction will lead to water quality benefits--regardless of the nature of the receiving waters into which an individual point source discharges.

The Occupational Safety and Health Act, as administered, in requiring engineering controls in preference to use of personal protective equipment, may impose inordinant costs on employers. Its requirement for the regulation of workplace exposure to toxic or harmful substances is but loosely guided by a test of "feasibility"--a test which, absent greater legislative specificity, invests the Act's administrators with immense, and potentially problematic discretion.

Statutory inflexibility with regard to consideration of costs under each of these three statutes is compounded by the fact that regulatory decisions must often be made based upon incomplete or essentially inconclusive

scientific evidence. Regulatory intervention to avert possible, but uncertain, adverse health or environmental effects carries a high cost.

During the relatively short time these three major environmental, health and safety statutes have been in effect, their administrators have recognized the need to take costs into account--sometimes in face of contrary statutory mandate--in order to avoid gross economic dislocation. Their actions, in so doing, are subject to pending legal challenges. Courageous and creative administration of inflexible statutes is not a substitute, however, for balanced legislative guidance on reasonable regulatory goals.

The need for fresh, balanced legislative guidance is pressing. While gross economic dislocations have been avoided, the current legislative framework has yet to be fully enforced. OSHA has regulated only 16 of the thousands of health-affecting substances found in the workplace. EPA and the states are still exploring the true import of "no significant deterioration." "Best practicable technology" has not yet been attained by many point sources of effluent discharge--much less the more expensive "best available technology" currently required by 1983. The "potential energy," as yet unexpended, of the current regulatory framework is, thus, enormous.

If the regulatory system is to be made amenable to more balanced consideration of economic costs and technological feasibility, there is no alternative but to seek appropriate legislative amendments to the existing legal framework.

Although, for reasons which the legislative analysis above makes clear, opportunities for increasing the consideration of economics in the regulatory process are limited, it is nonetheless important to note that there is some room for improvement within the current framework--particularly through the strengthening of the administrative processes associated with the Inflation Impact Statement and the Environmental Impact Statement:

- The Inflation Impact Statement program was formally initiated by Executive Order in November 1974. It requires Federal agencies to consider the economic impact of their

major regulatory and legislative proposals. The program was recently evaluated by the Council on Wage Price Stability and the Office of Management and Budget. The evaluation suggested that the implementation and effectiveness of the program had been uneven. It provided recommendations for broadening the scope of the program (and, as a minor corollary, changing its name to "Economic Impact Statement"), and for strengthening its administration--recommendations which are entirely consistent with the argument of this paper.

- The Environmental Impact Statement (EIS) is a requirement which derives from the National Environmental Policy Act of 1969 (NEPA). It requires that EISs be prepared prior to decision on "major federal actions significantly affecting the quality of the human environment." Two approaches to improvement of the Environmental Impact Statement process are outlined at Appendix B.

Increasing the Quality and Credibility of Relevant Technical Information

As the review of empirical evidence suggests, there is a major need for improved data as to both costs and benefits associated with regulation. There is, in addition, a need for improved technological assessment where the costs, or even the possibility, of meeting alternative regulatory standards depend upon technological development which has not yet taken place. In general, the following directions merit pursuit:

- The Federal Government, and the Commerce Department in particular, should improve its capacity to perform objective analyses of actual and potential economic impacts of individual regulations and combinations of regulations. Such analysis should be done with respect to individual industries and regions--as well as in macroeconomic terms.

- The Government should increase the funding of epidemiological research as to the relationship between the incidence of adverse health effects and varying levels of pollutants, toxic materials and harmful physical agents.

- The Government should increase the funding of systematic ex post evaluation of the effects of environmental, health and safety regulatory programs--just as it did in the late 1960s and early 1970s with regard to their recently emergent social expenditure programs.

- In order to help non-scientific decision-makers resolve disputes among expert scientists on issues of fact and scientific judgment, in order to help clarify distinctions between issues of science and issues of value choice, and in order to point up significant areas of relevant uncertainty on which to focus additional research, the Government should experiment with the use of an expert "Scientific and Technolgical Inquiry Board(s)" to review and advise upon the scientific elements of major regulatory policy problems--and, indeed, to help determine, with restraint, the problems serious enough to merit such special review. (This is not to suggest that decision-making authority should be delegated to such a body; nor is it to suggest that the quest for "truth" should ever be removed from the competitive marketplace of ideas.)

Devolving and Coordinating Regulatory Discretion

The Federal Government has only recently assumed its current, very extensive role as a direct regulator of the human work and leisure environment. Both the legal obligations and administrative discretion of Federal regulators are immense. The existence of this relatively new regulatory authority, as well as its exercise, has created anxieties about the proper distribution of authority in our Federal system. The issue is not one of constitutional abstraction. Rather it is whether the current, highly centralized regulatory scheme yields results consistent with our society's expectations

with regard to the proper interplay of citizens and governmental institutions at all levels.

This problem of alienation and anxiety is compounded by the fact that Federal Governmental regulatory schemes are often ill-coordinated in design. An OSHA standard may require ventilation of the workplace to remove a harmful substance, while an EPA standard may forbid ambient emissions of the substance. Control systems to remove the substance from a plant's exhaust may yield a sludge which must meet solid waste controls. The failure of legislation at the Federal level to account for the interdependence of environmental, health and safety objectives becomes magnified on local application.

Thus, there exists both a vertical and horizontal dimension to the problem of rational regulation. The vertical problem is assigning proper roles to Federal, state and local authorities for the execution of a given statutory scheme. The horizontal problem is enabling better coordination of interdependent regulatory consequences at an appropriate level--e.g., a state environmental agency which has no authority to alter the terms of an effluent discharge permit under the regulatory regime of the Federal Water Pollution Control Act, cannot adjust these terms to fit state or local, air pollution, solid waste disposal or air pollution problems.

There is, thus, great social and political as well as economic "friction" in our current environmental, health and safety regulatory systems. We have created an obstacle course which may slow capital formation to a greater extent than necessary, and which, when manifest at the local level, erodes confidence and respect for governmental process. It is highly important that expedited, further study be done of means to better distribute and coordinate regulatory authority on both vertical and horizontal planes.

The principal Federal environmental, health and safety laws discussed previously, were enacted out of Congressional discontent with the pace and efficacy of state level regulation. Each, in measure, usurped for the Federal Government, functions traditionally left to state and local authorities. Each, however, gives, at least, lip service to the vital role of states in the regulatory process:

- The Clean Air Act states that "prevention and control of air pollution at its source is the primary responsibility of States and local governments."

- The Federal Water Pollution Control Act declares that it is the policy of Congress "to recognize, preserve, and protect the primary responsibilities and rights of States" to combat water pollution.

- The Occupational Safety and Health Act states a purpose of "encouraging the States to assume fullest responsibility for the administration and enforcement of their occupational safety and health laws."

It is timely to consider means, administrative and where necessary legislative, to devolve some of the Federal Government's regulatory responsibilities to states, consistent with the above statutory themes. Simultaneously, means must be found to foster better coordination, at all relevant levels, of the exercise of interdependent regulatory authorities. Such a reallocation of legislative authority and administrative discretion need not dilute our national commitment to achieving environmental, health and safety goals. To the contrary, such a redistribution may be a prerequisite to continued political support for the regulatory goals already enumerated.

Another way, of course, to devolve decision-making authority with regard to environmental, health and safety objectives, is to allow a greater role for economic or market incentives. Such incentives can also add flexibility and rationality to the regulatory system.

Increasing the Flexibility and Efficiency of the Regulatory System

The analysis in Part (B), above, makes clear that the current regulatory system suffers in many respects from inflexibility and inefficiency. And it is generally agreed among academics concerned with regulatory policy that increased flexibility and efficiency requires greater reliance upon more market or quasi-market incentives. Charles Schultze has most recently argued for this point of view in the Godkin Lectures at Harvard. And, indeed, he has appropriately placed the burden of proof on those who would deviate from the "rebuttable presumption" in favor of market mechanisms.

It might well be argued, for example, that the current OSHA legislative framework and strategy deviate far more than is necessary from market-based incentives. That is, it might be argued that while certain hazards undoubtedly require direct and uncomprising regulatory standards and prohibitions, many may be left to the regulatory powers of information in the marketplace of ideas and such economic incentives as would arise through the collective bargaining process and, e.g., through a more focused, experience-rated workers compensation system. Schultze, it should be made clear, does not make this particular argument--nor would any politically sensitive policymaker; for it tends to inspire particularly emotion-laden argument. In the hope of preserving the spirit of reasonableness which this paper intends, this argument is not developed here. Rather, to elaborate upon the general point as to the needs and opportunities for more flexible and efficient regulatory strategies, the problem of water pollution abatement is taken as a case in point.

An extensive and continuing debate has centered on how pollution abatement can be achieved efficiently and equitably. Basically, two strategies have been considered: (i) standards--technical controls on inputs and outputs of pollution-creating activities; and (ii) economic incentives--fines (or subsidies) for depositing (or abating) residuals. (An interesting variant upon an economic incentive strategy involves the creation of a limited market in transferable government permits to pollute; while interesting theoretically, this is deemed to have little practical political potential.)

Standards have the following advantages. They place the costs of pollution-creating activities on the polluter. And technical standards based upon information supplied by polluters can minimize the costs of environmental management.

But standards have many disadvantages. They require that the environmental control authorities have knowledge about the damages of pollution and the costs of abatement. If inputs, rather than outputs, of pollution-creating activities are specified, Government must know not only costs and benefits associated with different degrees of pollution abatement, but also the optimum method of pollution abatement. Standards not only prevent the use of technologies and inputs that produce unacceptably high levels of pollution, but they also typically tend to foreclose other options which may be or become efficient alternatives; they reduce incentives for experimentation in ways to improve technology. Further, uniform technical standards result in misallocation of the burden of pollution-reduction among polluters, while a detailed set of specific rules for each polluter is highly expensive and cumbersome.

Economic incentives are advantageous in the following respects. Polluters are given freedom of choice with respect to the method used to abate pollution and the amount by which their contribution to pollution is to be reduced. And polluters for whom abatement is difficult as well as polluters able to abate quickly, can be dealt with in accordance with the pollution damage they cause.

But economic incentives have the following disadvantages. If subsidies are used to induce abatement and direct public investments, the costs are borne by society generally and, to the extent that pollution is not fully abated, by receptors. The amount of fine levied on (subsidy given to) polluters and received (paid) by each individual receptor is unlikely to be very closely related to the actual damage to him from pollution. If polluters do not have to pay fully, then they have no incentive to consider the potential environmental consequences of new activities and processes; i.e., incentives may confer a license to pollute. Incentive systems can be as complex as standard-setting, requiring information on costs and damages, and additional information on market structure and firm behavior.

Most academic economists and others who have carefully considered the means to achieve environmental objectives regard effluent fees as the more efficient mechanism. They provide greater flexibility regarding technological options which will lead to greater reductions in pollution and enable market processes to operate with fewer distortions. The major difficulty lies in measuring marginal damages and hence the appropriate level of fees.

A recent proposal by EPA--the "Non-Compliance Fee"--would combine existing effluent limitation guidelines (discharge standards) with a fee on industrial dischargers who fail to comply with the guidelines in a timely fashion.* Dischargers would be required to pay a fee equal to the estimated capital and operating costs of compliance. In addition, there would be administrative and legal costs associated with non-compliance.

Such a system, if instituted, would nullify economic advantages to dischargers resulting from non-compliance. It should make compliance the least-cost alternative. Clearly, the Non-Compliance Fee would hasten compliance with the requirements of the Federal Water Pollution Control Act. (Connecticut has had very good experience with such a plan.)

On the other hand, the system has some drawbacks. It does not ameliorate the problems associated with standards. The Non-Compliance Fee system is superimposed on existing regulatory standards. Compliance fees (penalties) are not effluent fees, that is, they are not related to the volume of pollutants discharged. Rather, they influence the timing in meeting specified requirements. Thus, the Non-Compliance Fee system will not ameliorate the problems of differential impacts, promote technological improvements to abate pollution, or induce further industrial efforts to reduce pollutant discharges.

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* The Environmental Protection Agency draft bill "To amend the Federal Water Pollution Control Act," EPA, 95-12. For a general discussion of mixed strategies for pollution control see Michael Spence and Martin Weitzman, "Regulatory Strategies For Pollution Control," paper presented at the Massachusetts Institute of Technology Conference on Air Pollution and Administrative Control, December 2 and 3, 1976.

The institution of this system should bring industrial dischargers into compliance with the FWPCA 1977 goal of best practicable technology (BPT)--and, as an enforcement strategy, this merits support.

Over the longer run, however, it would appear desirable that a mixed strategy of regulations and effluent fees be developed in such a way that there is greater flexibility with respect to technology (that is, enabling firms to utilize whatever technology will permit them to go beyond mandated BPT targets) and in a way that minimizes the necessity of knowing precisely the marginal damages of pollutant discharges in order to determine the fee structure.

A mix of regulations and fees along the following lines merits consideration.

First, there should be a minimum requirement that all firms are required to attain. That level could be the 1977 BPT effluent limitations requirements. Beyond that, in moving toward "zero discharge" one could well consider a system wherein the regulatory standards are supplemented by a system of effluent fees. However, an improved variant might be a system that would be flexible in that "experience rating" in the form of a pollution abatement credit would be used to vary the effluent fees. It would provide a credit to those firms which achieve measurable reductions in pollutant discharges. It would enable firms to utilize whatever technology or measures can achieve further pollutant reductions in light of their cost and market conditions. Some dischargers will be able to move quickly; others will be able to move slowly--in both cases, there would be an incentive to reduce the effluent fees by developing technological processes or imaginative ways in which to reduce pollutant levels.

The pollution abatement credit strategy would be based on a national goal of maximum reduction of pollutant discharges. In generalized form, the proposed strategy would be as follows:

- As a starting point, all industrial discharges would be required to meet the 1977 BPT requirements. (The Non-Compliance Fee proposed by EPA would speed-up compliance to attain this level of pollutant reduction.)

- In place of specific best available technology (BAT) requirements, an effluent fee would be imposed upon all firms which are not at the equivalent of the BAT level. The fee formula could be established by using BAT cost of compliance as a starting point. (Estimates of BAT compliance costs are already available for many industries.)

- The fee formula could be adjusted over time, as necessary, in light of increased knowledge about damages and in light of newly identified pollutants.

- As industrial dischargers reduce pollutant loadings below BPT levels, they would receive a credit against the effluent fee--based on pollutant reductions over a specified period of time (e.g., a quarter). (Dischargers would request EPA review and certification of the level of pollutant reduction they achieved and on that basis receive the credit toward the effluent fees.) The greater the reduction in pollutant loadings beyond BPT, the larger the credit given to the discharger.

- Revenues accumulated, which may be expected to decrease over time, could be used for environmental protection purposes.

Since the timing and the level of the fees would depend on the discharger's economic and technological conditions, it would not be necessary for the government to measure precisely the "marginal damage functions" in order to determine the fees. (Individual firms, however, would measure costs associated with alternative effluent levels and would determine their behavior in view of the balance with respect to alternative fees.) Automatic adjustments would be made through the pollution abatement credit process to bring damages, fees, and costs into balance.

This strategy would be more efficient and equitable than either regulations or fees alone. It would: introduce the firm's ability to abate pollution as a competitive factor to be reckoned with in the firm's operation; automatically promote the development and application of improved technology; automatically allow and encourage self-regulated adjustment of pollutant discharges to minimize economic impacts on and between firms and regions; and increase flexibility in determining control priorities and in dealing with new or recurring problems.

Whether this scheme, or some other market-oriented variant, is appropriate may usefully be debated.

In any case, it is becoming increasingly clear that the policy choice cannot be viewed as simplistically as has often been characteristic in past debate. The choice is not "the market" on one side versus some crude, uniform regulatory intervention strategy on the other. As a complex society interested in preserving both the values of the marketplace and certain human, social and environmental values, America must invent new means of intervention--means which mix direct regulation with more market-oriented incentives--to foster a more creative and more efficient interrelationship of the public and private sectors. A great deal of analysis, reanalysis and detailed policy development remains to be done. But clearly this would seem to be the direction toward regulatory reasonableness.

APPENDIX A

COPPER AND PAPER INDUSTRIES: REGULATORY IMPACT STUDIES

The Office of Business and Legislative Issues, Bureau of Domestic Commerce (BDC) has recently engaged in studies to determine the impacts of environmental, safety and health regulations on the copper and paper industries. The BDC studies extend or augment earlier studies on these industries performed by Arthur D. Little, Inc. (ADL) for the Environmental Protection Agency. This appendix, prepared by the Office of Regulatory Economics and Policy, summarizes the two BDC studies.

REGULATORY IMPACT STUDY: COPPER INDUSTRY

The Bureau of Domestic Commerce (BDC) is currently conducting a study to analyze the impacts of Federal and state regulation of the copper industry. Utilizing the Arthur D. Little, Inc. (ADL) copper industry model, the BDC study will measure the combined impacts of environmental, safety, health and related regulations on the industry. In addition, the study will analyze the implications for the industry of unquantifiable or intangible aspects of the present regulatory structure, e.g., inconsistencies within regulations or conflicts between regulations.

The ADL Study

The BDC study represents an extension of an ADL study of the copper industry performed for the Environmental Protection Agency (EPA). The ADL study employed an econometric model of the copper industry to project the effects of environmental regulations on certain key economic variables such as prices of refined primary and secondary copper, domestic production tonnage, net imports, total consumption and industry employment. In the ADL study, the regulatory impact considerations were limited to EPA's environmental regulations--largely air pollution. Sulfur dioxide (SO_2) emission limitations and controls on copper smelters are generally considered to comprise the major impact of environmental regulation in the copper industry. Consequently, the ADL study focused on the restraints imposed on the smelting sector of the copper industry as a result of compliance with EPA and State Implementation Plans (SIPs), SO_2 emission regulations, the New Source Performance Standards (NSPS) SO_2 control requirements, smelter modification and reconstruction restrictions, and SO_2 Secondary Control System (SCS) limitations.

The ADL study compares two scenarios, "constrained capacity" and "reduced capacity," to a projected "baseline" condition. The baseline assumes that, subsequent to 1974, there are no additional regulatory constraints on the copper industry. The constrained capacity scenario assumes that all existing smelters will continue to operate at their present capacity and that an additional 200,000 tons per year of new "grass roots" smelter capacity will be brought on stream in 1984 and 1985. The reduced capacity scenario assumes that two smelters will close (McGill, 78,000 tons capacity, in 1977 and Douglas, 90,000 tons capacity in 1979) and that regulatory uncertainties and economic conditions will delay any new grass roots smelter capacity coming on stream until 1985.

In addition to these capacity constraints, ADL calculated a dollar cost of compliance for EPA's air and water regulations that would be incurred by the industry. The ADL estimated cost of environmental control over the period averages about 7.3 cents per pound of refined copper produced; 6.2 cents per pound is for air pollution control.

Based on the reduced capacity scenario, the ADL industry simulation model projects the following economic consequences to the industry by 1985:

- The price of primary refined copper will be increased by 26¢ per pound, 24.4 percent, over the baseline projected price level.

- Primary refined copper production by the domestic industry will be reduced by 29 percent from baseline projected levels; production capacity will fall short of the baseline level by one million tons per year.

- Total domestic consumption of copper will be reduced by 8.1 percent, representing a probable shift to substitute materials and products.

- Employment in the copper industry will be reduced by 26.3 percent from normal levels, representing a total (direct, indirect and induced) employment loss of possibly 80,000 jobs.

- Net imports of copper will increase by 39.0 thousand tons, 10.3 percent, over baseline net imports projected for 1985.

The BDC Study

The BDC has broadened and extended the coverage and scope of the ADL study. The BDC work covers ore mining, ore concentrating, copper refining and secondary copper processing as well as primary copper smelting. The regulatory impacts considered include the effects of:

- EPA's air quality regulations for particulates and nitrogen oxides on mining, concentrating, refining, and secondary smelting.

- EPA, State, and local water pollution regulations (EPA's no-pollutant discharge regulations and Pre-Treatment requirements; Clean Drinking Water Act proposals; State Fish and Game regulations; underground water seepage and water table and acquifer protection, and surface water runoff control) on all phases of copper production, especially mining and concentrating.

- OSHA's worker safety regulations, particularly explosives handling at ore mines, and smelter safety requirements.

- OSHA's noise control regulations on mining, concentrating, and smelting operations.

- Other OSHA worker health regulations, particularly the restrictions on worker exposure to arsenic and metallic vapors at smelters and to acid mists, arsine, and other "hazardous substances" at refineries.

- Various proposed solid waste disposal regulations (Department of the Interior and Department of Agriculture regulations; Resource Recovery and Conservation Act) on tailings disposal at concentrators and on slag disposal at smelters.

- Federal and State withdrawals of land from mining entry and other related land-use restrictions.

- Current and proposed air quality non-degradation plans including the establishment of Mandatory Class I "clean air" regions.

- Conflicts and inconsistencies between regulations and jurisdictional uncertainties. For example, there is conflict between proposed OSHA and EPA noise levels (90dBA vs. 85dBA) and ambiguities in compliance requirements between EPA New Source Performance Standards and State ambient air quality violation enforcement.

- Unquantifiable or intangible aspects of the present regulatory structure on productivity and on the management-decision process.

In extending the ADL work, BDC finds that the ADL constrained capacity scenario is unlikely to occur. The reduced capacity scenario is more probable because:

- Engineering and construction lead-time requirements preclude any new grass roots smelting capacity coming on stream before 1983. Environmental regulations will severely restrain the addition of new grass roots smelting capacity after 1983.

- Sulfur dioxide emission control regulations will prevent existing smelters from expanding capacity or increasing present production levels, other than a relatively insignificant 3 percent production increase over the period 1976 to 1983.

- The McGill smelter has already closed.* The BDC analysis confirms that the Douglas smelter will probably close in 1979. Additionally, a third smelter (Tacoma, with 8 percent of present smelting capacity) may close because of OSHA arsenic standards. Together, these three smelters comprise 19 percent of existing copper smelting capacity.

The additional compliance costs and capacity constraints will be used in a simulation of the ADL industry model to get a more comprehensive estimate of the probable impacts of regulations on the copper industry. While the model analysis has not been completed, based on the preparation of the necessary cost information BDC has found the following:

- Compliance with regulations other than those considered by ADL will increase costs in the copper industry by $800 million, or approximately 50 percent of the ADL estimated environmental compliance costs. ADL estimated that annualized investment plus annual operating costs would amount to $1.7 billion for the period 1976-1985.

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*The EPA 1976 third quarter report of the Economic Dislocation Early Warning System states that as a result of a preliminary court injunction against EPA, the McGill smelter may soon reopen.

- There will be an appreciable increase in the magnitude of the unfavorable effects projected by ADL.

REGULATORY IMPACT STUDY: PAPER INDUSTRY

The Bureau of Domestic Commerce (BDC) recently completed a study of the impacts of Federal and state regulation on the pulp and paper industry. The BDC work augments an Arthur D. Little, Inc. (ADL) study prepared for the Environmental Protection Agency (EPA).

The ADL Study

The ADL analysis dealt with the impacts of air, water, and OSHA noise regulations on a portion of the pulp and paper industry --mills through semifinished products. ADL projected the capital and operating costs for selected sectors of the industry to comply with these regulations. Cost models were used to determine the impact of these compliance costs on the prices of semifinished paper products. The period studied was 1975 to 1983. The regulations considered were:

- Air regulations -- those issued by states (State Air Quality Implementation Plans-SIP) for the existing industry, and those issued by EPA as they apply to new capacity.

- Water regulations -- those issued by EPA for existing and new capacity. Two levels of control for the existing industry were assessed--that for compliance with BPT ("best practicable control technology currently available"), which is promulgated for 1977, and BAT ("best available technology economically achievable"), which is proposed for 1983. Estimates of control costs for new capacity were based on New Source Performance Standards (NSPS).

- Noise regulations -- those issued by the Occupational Safety and Health Administration (OSHA) for compliance with a 90dBA noise level using engineering and/or administrative control to achieve compliance. Noise regulations apply equally to both existing and new industry capacity.

The BDC Study

The BDC has broadened and extended the coverage and scope of the ADL work to include the effects of air, water, land withdrawal,

safety and herbicide-pesticide regulations on woodland operations and, subsequently, on the entire paper industry. The BDC study also catalogues a number of regulatory uncertainties which affect the paper industry.

Federal actions exert upward price pressures on U.S. timber supply by diminishing the availability of timber and requiring practices that directly affect growing and harvesting costs. The following is a reasonably comprehensive, though not all inclusive, listing of Federal laws, regulations and policies that directly or indirectly affect costs and prices.

- Forest Service policy requires environmental assessments and Environmental Impact Statements on timber sales in order to conform with the National Environmental Policy Act (NEPA). These evaluations incorporate logging practicies for sale tracts that may pose restrictions on equipment used, road type and spacing, and endangered species habitat protection. While Forest Service pricing practices take the costs of environmental restrictions into account there is some question as to whether all costs are absorbed. In any event, the time required for these evaluations and litigation in many instances reduces public timber availability.

- Federal restrictions on use and application techniques of herbicides increase the rotation period for merchantable timber, both public and private, with an ensuing supply reduction.

- Pesticides are available under present regulations, but at a higher cost.

- Pending OSHA noise regulations will increase the cost of timber harvesting equipment such as chain saws, tractors, stationary engines, etc.

- Highway Safety Act requirements for bridges, guard rails, signs, etc., on some classes of logging roads and Mining Enforcement and Safety Administration regulations for quarries, and sand and gravel pits raise the costs for road building.

- The Clean Air Act's nondegradation provisions--still subject to legislative action at this time--could require more costly slash disposal methods than burning and could also restrict controlled burning as a forest management tool, thus requiring greater use of more costly herbicides.

- The National Forest Management Act of 1976 will relieve the strictures on timber sales of recent court decisions (Monongahela -Tongass decisions), but opens up the possibility of new environmental pressures, more justification required for sales, and environmental uncertainties inherent in any new legislation. Timber availability could be reduced.

- Federal land withdrawals, such as under the Wilderness Act, Wild and Scenic Rivers Act, Alaska Native Claims Settlement Act, and Antiquities Act, and administrative land withdrawals have reduced timber availability from public lands with unknown impacts on future supply/demand relationships. Indications are the impacts could be substantial. Federal lands withdrawn have increased from 140 million acres in 1968 to 500 million in 1974 out of a total of 742 million acres.

There is a further problem of disruptions in planning. In the past, new capacity required two to three years to come on stream and then as much as a year to work up to peak efficiency. In recent years, Federal actions have extended the planning horizon from 2-3 years to 3-5 years. There are "worst possible case" estimates of eight years required between preliminary decision and finished plant. A representative list of regulatory problems that cause delays follows.

- Site selection problems: Pulp and paper mills must locate close to their raw materials (wood) base and an abundant supply of water. Detailed environmental assessments are required to select the site where requirements of the FWPCA and Clean Air Act can best be met. These can take as long as a year.

- Effluent discharges permits: This is a time consuming process which is lengthened in those states (approximately one-half) which have not qualified as permitors under the National Pollution Discharge Elimination System (NPDES). In these states the permit must be obtained from EPA.

Under NEPA, obtaining a permit from EPA for a new plant is a Federal action affecting the environment which requires an environmental assessment. This process can take up to two years without litigation.

- Plant design problems: Many Federal regulations present moving targets. Cases in point are the unresolved non-degradation section of the Clean Air Act, the present uncertainty about toxic substance control, the proposed OSHA noise standard (90dBA or 85dBA) and the OSHA Standards Completion Project which will in time regulate SO_2, turpentine and other chemicals common to pulping and papermaking. Regulatory compliance has to be designed into the plant. Whenever interpretations of regulations are changed, costly and time consuming design and construction changes will result.

Finally, the lack of coordination between Federal regulatory agencies not only creates uncertainty but increases costs because of mid-course corrections in planning, design and construction. Cases in point are:

- OSHA proposed a 90dBA standard for industrial noise exposure. EPA opposed this standard as too lenient and promulgated standards below 85dBA for construction equipment which comes under EPA jurisdiction.

- There is insufficient coordination between EPA and OSHA in the hazardous substance area. For example, EPA and OSHA have not resolved the jurisdictional question of when the workplace atmosphere, subject to OSHA regulations, becomes a plant emission, subject to EPA regulations.

To the extent possible, the impacts of these additional regulatory constraints and uncertainties were incorporated in the BDC analysis.

Findings of the Studies

The BDC report presents the combined impacts estimated in the two analyses. The major findings of the studies are:

- The portion of the pulp and paper industry included in the studies will require capital expenditures of at least $6.4 billion over the period 1975-1983 for regulatory compliance. Of this total, $4.9 billion would be required to bring existing plants to compliance, $1.4 billion would be necessary for compliance of new and replacement capacity, and capitalized maintenance of $0.1 billion would be required.

- Wood costs by 1983 are estimated to increase by 20 percent or $8 per ton of production (average requirement). If capacity is fully utilized and the 20 percent increased cost assumption is valid, the industry would have to pay an additional $0.7 billion for its basic raw materials in 1983.

- Price increases necessary by 1983 to recover all regulatory costs will be approximately 11 percent over 1975 prices. Three percent will be due to land withdrawals and regulation of woodland operations and 8 percent due to regulation of mill operations.

- Twenty-seven mills have a closure potential because of Federal regulations, primarily environmental. Ten mills will probably close by 1977, with a resultant primary and secondary employment impact of 3,740 jobs. Seventeen more mills may close by 1983, with a further potential employment impact of 7,125 jobs.

  The twenty-seven mills subject to closure are regionally concentrated. Thirteen are in the Northeast and nine are in the North Central region.

- Foreign trade dislocations because of Federal regulation are projected to be minimal. U.S. wood cost advantages are likely to be narrowed.

Regulatory uncertainties, though not quantifiable, present a substantial problem for investment planning. The most significant of these are:

- Uncertainties arising from reinterpretation and extension of existing law created by civil action against a regulatory agency. Examples of this type of issue have been the air quality significant deterioration interpretation by the Federal courts and the Congress and court rulings on the Forest Service Organic Act of 1897 (Monongahela-Tongass decisions).

- Uncertainties due to differences in interpretation of a regulation on a regional rather than a national basis.

- Uncertainties which are created because of semantic differences in defining technology and the status of pollution control systems.

- Uncertainties in determining long-range effects on competition among domestic producers because they are affected differently by different regulations.

- Uncertainties produced by the promulgation of draft regulations which are controversial enough to take a substantial amount of time to clear the review processes and become final regulations.

- Uncertainties about the resolution of conflicts and the interactions among several laws or regulations.

- Lack of coordination between Federal regulatory agencies.

Apart from these legislative and regulatory uncertainties, the costs of many aspects of regulatory programs are presently nonquantifiable because of insufficient experience to build a data base, ensuing land-use problems (plant siting, land disposal of pollutants from air and water cleanup, raw materials and fuel availability), and future cost and availability of capital.

APPENDIX B

PROCEDURAL CHANGES TO IMPROVE THE ENVIRONMENTAL IMPACT STATEMENT PROCESS

The National Environmental Policy Act of 1969 (NEPA) requires Federal agencies to analyze the environmental effects of their proposed actions and of reasonable alternatives to such actions. This appendix considers several aspects of NEPA.

Part I, "Perspectives on the National Environmental Policy Act," was prepared by the Office of Environmental Affairs. This points to the importance of private and early interventions under NEPA. A study of how best to achieve this is ongoing through the Office of Environmental Affairs.

Part II, "An Approach to Procedural Changes to Improve Economic Considerations within the Current Framework of the Environmental Impact Statement Process," was prepared by the Office of Regulatory Economics and Policy.

PROCEDURAL CHANGES TO IMPROVE THE ENVIRONMENTAL IMPACT STATEMENT PROCESS

Part I. Perspective on the National Environmental Policy Act

The National Environmental Policy Act (NEPA) of 1969, P.L. 91-190, has been correctly called the "Constitution for Environment" of these United States of America. Since NEPA was signed by the President of the United States on January 1, 1970, it has become the centerpiece of the myriad of pollution abatement and other environmental protection legislation which have been enacted. A careful appraisal of our national experience in implementing NEPA suggests that the following aspects need to be carefully reevaluated towards improving the quality of the administration of this Act and ultimately towards meeting the national environmental goal ". . .to create and maintain conditions under which man and nature can exist in productive harmony and fulfill the social, economic and other requirements of present and future generations of Americans."

NEPA and the Environmental Impact Statement (EIS):

Over the years, the National Environmental Policy Act and the Environmental Impact Statement required under Section 102(2)(C) have become interchangeable terms and almost synonymous in the public mind. While it is true that the preparation of EISs on "major federal actions significantly affecting the quality of the human environment. . ." (emphasis added) has become the most salient feature of the Act, it is not necessarily the most important feature. As a matter of fact, it is almost impossible to prepare an EIS that will be useful to decisionmakers without first implementing successfully Section 102(2)(A) to "Utilize a systematic interdisciplinary approach which will ensure the integrated use of the natural and social sciences and the environmental design arts in planning and in decisionmaking which may have an impact on man's environment;" and Section 102(2)(B), "Identify and develop methods and procedures. . . which will insure that presently unquantified environmental amenities and values may be given appropriate considerations in decisionmaking along with economic and technical considerations." Succinctly stated, Sections 102(2)(A) and (B) provide the substantive requirements for preparing EISs called for in Section 102(2)(C). Because neither Sections 102(2)(A) or (B) have been properly implemented to date, EISs prepared pursuant to Section 102(2)(C) cannot satisfy the needs of the decisionmaker for attaining the national environmental policy goal. For example, effectual procedures and requirements for the inclusion of essential economic and other social sciences information in the EIS have never been established.

The National Environmental Policy Act and the Primary Decisionmaker:

The entire focus of NEPA is on "major federal actions significantly affecting the quality of the human environment." Similarly, the guidelines established by the Council on Environmental Quality (CEQ) for the implementation of NEPA are aimed at responsible federal officials. However, in reality, an estimated 70 to 75 percent of all of the projects which eventually fall into the category of "major federal actions" requiring a detailed environmental statement actually originate in the private sector. These projects usually result from primary decisions made by private entities two, three or more years before the project enters the federal sector. In point of fact, most so-called "major federal actions" become "federal" simply because the project developer eventually needs some sort of federal subvention (e.g., license, permit, subsidy, etc.) for the project to become operational. A major deficiency under the existing CEQ guidelines, is the lack of a clear channel for the delivery of federal guidance and quality assurance to the primary decisionmaker before the first and frequently the most important "action" decision is made. As currently implemented, the EIS requirement is triggered only when the project developer petitions the federal government for subvention.

The Merits of a Project -- Changing Perceptions:

One of the major causes for controversy and litigation over the implementation of NEPA and particularly over the question of adequacy of EISs is the fundamental difference in perception of the merits of a project from the time of its inception until the taking of the formal federal action.

Historically, projects which originate in the private sector and which require governmental approval, e.g., electrical generating plant, are justified or "sold" to governmental officials on the economic benefits that would flow from the project. Increased tax revenue, a higher level of employment, and accelerated economic development of the area have been among the standard justifications for approving a project. After the enactment of NEPA, environmental considerations, including unquantified amenities, were imposed on the federal bureaucracy as part of the yardstick for measuring the value of a project and ultimately deciding if the petitioner's request for a federal subvention should be granted.

After more than six years of attempts to implement NEPA, we are beginning to recognize what should have been obvious from the outset; namely the criteria for measuring the degree of "goodness" of a project at the project impact site are considerably at variance with the criteria for measuring the merits of the project at the

federal level. Harking back to the steam electric generating facility as an example, once the local electrical utility decides that a new facility is required in order to meet projected market demand, the approval of the site selected is gained by convincing local officials that economic benefits will outweigh any environmental liabilities. As the review of the project proceeds from the local governmental level through the county, state and ultimately into the federal sector, it gains an economic and political momentum which may become almost irresistible by the time that the EIS process comes into play. Available options have become pre-empted in the process.

At the same time that the project is gaining economic and political force, the perceptions of its merits shift from the almost wholly economic criteria of the utility to the almost exclusively environmental protection criteria of the EIS, which for all practical purposes excludes economic considerations. Thus, the stage is set for a bitter and unproductive confrontation between those who support the project and those, far removed from the impact site, who perceive only the environmental liability that will ensue from the project.

Conclusions:

NEPA is an important means for internalizing environmental values in the decisionmaking process. In a free enterprise economy and a federal system of national, state and local governments, decisionmaking is a shared activity involving many groups in addition to the federal government. Most major actions affecting the quality of our environment are conceived and are implemented by non-federal organizations. The achievement of national environmental policies and full implementation of NEPA cannot take place until an effective means is developed for assuring balanced consideration of environmental interests at the "front end" of project planning; i.e., at the time that decisionmakers in the private and/or the local sectors begin the decisionmaking process. Only then will NEPA become fully accepted as an aid in project planning, rather than a post-decision, administrative and legal hurdle that the planner must overcome in order to proceed.

Note: Part II follows at next page.

Part II: An Approach to Procedural Changes to Improve Economic Considerations within the Current Framework of the Environmental Impact Statement Process

The problems of the American economy in the 1970s have occasioned renewed interest in the potential tradeoffs between protection of environmental amenities and economic growth, productivity and price stability.

There is a pressing need to improve the instruments used by the federal government to evaluate its proposed actions so as to make explicit the evaluation of tradeoffs that are involved.

One possibility for making such improvements lies in modification of the existing EIS process to give it greater focus and structure. This paper proposes an approach to the use of the benefit/cost (B/C) paradigm in the EIS.

Fundamentally, the EIS is a tool for decisionmaking. As such, it has three specific purposes: 1) to discipline the decisionmaking process by forcing it to be systematic; 2) to structure a formal flow of information between government agencies (both federal and non-federal) and between government and private citizens; and 3) to improve coordination of governmental activities.

Logically, the basic content of a model EIS should answer a sequence of about ten questions:

1) What is the problem motivating potential federal action and why is it a problem?

   A brief section of no more than a few paragraphs should suffice, specifying the perceived problem and its causes.

2) What is the geographic setting?

   Here, the regional dimensions of the problem should be spelled out. Those locations directly affected by any potential action should be defined.

3) What are the alternative ways of dealing with the problem?

   Sometimes there will only be two alternatives, one of which is to do nothing. In other cases, the number of alternatives may be numerous. The alternative of no action should always be considered an approach, if for no other reason, to provide a

benchmark against which other alternatives can be evaluated. Where a large number of alternatives are theoretically possible, some rational justification should be offered for selecting those to be considered in some detail.

4) What are the probable ecological, social, economic, and cultural consequences (both short- and long-run) of each alternative course of action?

This section should be the heart of the EIS, spelling out expected environmental conditions likely to prevail for each possible course of action (including no action). Short-term environmental disturbances (those likely to prevail only in a transitional stage) should be indicated as well as the sustained environmental effects.

5) What adverse ecological, social, economic, and cultural consequences of each alternative course of action appear to be unavoidable, given the present state of technology?

In this section, attention should be focused on those impacts which might be considered adverse. Where possible, a B/C analysis of alternatives for mitigating (or avoiding) the impacts would be appropriate.

6) On the basis of measurable factors, what is the cost-effectiveness of the alternatives?

There are several ways to do cost-effectiveness studies. The analysis should include an evaluation of the tradeoffs present between the alternatives. Where the alternatives have dissimilar beneficial side effects, B/C analysis may provide the best vehicle for a preliminary ordering of the alternatives.

7) Are there any reasons not to select the alternative that is most cost-effective, as indicated above?

In this section, special attention should be paid to quantifiable and nonquantifiable factors and to irreversible and irretrievable commitments of resources which cannot be adequately incorporated into cost-effectiveness studies.

8) What alternative course of action is preferred, and why?

A course of action is selected from among the various alternatives and the rationale for that selection, explicitly including subjective evaluation of tradeoffs between incommensurates, is presented. The reasons for not selecting each rejected alternative should also be spelled out.

9) What actions will be taken to minimize the adverse effects of the chosen course of action?

In this section, reference back to discussion related to Question #5 would be in order. Yet, the section should clearly indicate what will and will not be done to minimize potentially harmful environmental effects and explain the reasons for each decision.

10) What agencies, institutions, firms, and private individuals have assisted in preparing this EIS?

This final section should provide information allowing a reader to evaluate the objectivity of the EIS.

If the CEQ guidelines were to specify a set of such questions to be answered by the EIS, the EISs would have comparable structures. An EIS might still be incomplete because the quality of the analysis involved in answering one or more of the questions is inadequate, and no guidelines, regardless of how tightly drawn, can prevent such inadequacy. But, by imparting a structural skeleton to the EIS, CEQ guidelines could help dispel some of the misconceptions about what the document ought to contain and give agencies clearer criteria for judging what is required.

Use of B/C Analysis

The usefulness and limitations of B/C analysis in evaluating public investment decisions are well-documented /See 5/. The chief problem in applying B/C analysis is that some costs and some benefits are not easily translatable into monetary units.

It might be desirable to deal with the problems of assigning monetary values to certain benefits and costs. Two examples help to illustrate what is, and is not, possible. The first is Klarman's use of the tool to evaluate a syphilis eradication program in the U.S. /4/. There are three types of benefits: 1) avoidance of

medical expenditures; 2) avoidance of loss of current production; and 3) avoidance of pain and discomfort. The first two are within the realm of traditional economic measurements; the third much less so. But an arbitrary, albeit reasonable, figure can be assigned, and if the assignment is explicit, can be debated and/or adjusted to determine how sensitive the B/C ratio is to the arbitrary adjustment. Mishan calls such sensitivity analysis "contingency calculations" /5, p. 161/. The second example of a relatively sophisticated use of B/C analysis where measurement problems are encountered is a recent study by Weber examining cancer prevention through control of use of asbestos /6/. Again, the problems of psychic costs are encountered, but dealt with by a series of arbitrary (if plausible) assumptions that can be relaxed to determine if the B/C ratio is sensitive to them.

Mishan demonstrates in a very straightforward way how the contingency calculation procedure works /5, pp. 160-162/. Suppose the B/C analysis of a proposed environmental regulation indicates that annual measurable costs will exceed measurable benefits by ten million dollars. The analysis is premised, however, upon a somewhat arbitrary assumption that the psychic costs of the particular environmental disamenity are ten dollars per person per year. Hence, the proposed regulation reduces total psychic costs annually by about 2.15 billion dollars. If the total psychic cost per person is really twenty dollars, an additional 2.15 billion dollars in benefits are realized from the regulation, and benefits are greater than costs. Indeed, if the analysis has underestimated the psychic costs by just five cents per person, that error would more than account for the ten million dollars that costs exceed benefits. Since the estimation of these psychic costs were admittedly an arbitrary estimate, a decision to move ahead with the regulation could easily be justified. The B/C analysis, thus, helps to pinpoint critical, sensitive elements in the decision nexus, and by so doing, it greatly sharpens the focus of discussion and debate.

A concrete example also helps to illustrate how B/C analysis can be performed usefully when various regional accounting stances are assumed. Hite and Stepp undertook such analysis with regard to granting state permits for location of industrial facilities in a coastal area of South Carolina. /3/. Their analysis showed that at the state level, benefits exceeded costs, but at the local (two-county) level, costs exceeded benefits. Thus, the facilities would serve to have a net benefit to the entire state (primarily because of the state tax structure), but a net cost to the local area in which they were to be located. Possible approaches for the state to compensate the locality then became a viable item of discussion, and contingency calculations could be made to determine what happens to benefits and costs under various approaches.

Methodological Consistency

To the extent that every problem occasioning an EIS is unique, there is some justification for arguing a standard approach to B/C analysis will not suffice in all cases. But there are areas in which standardization is altogether feasible. For instance, the discount rate to be used can be standardized, much as now is done under provisions of the Water Resources Council's "Principles and Standards" /2/. Standard values to be used in computing the loss of human life and limb, while at best arbitrary, would also help to assure that EISs are comparable in this regard. Procedures for estimating recreational benefits could also be standardized. Baseline projections on population and economic output could be specified. Consistent procedures would reduce biases in the analyses.

Regional Analysis

The regional diversity of the American economy introduces subtle complexities into the differential impacts of federal actions on the various states and areas of the country. Earlier in this paper, there was a brief discussion of how B/C analysis might be adapted to recognize various regional accounting stances. In this section, the problems of regional analysis are given more detailed attention.

When one opens the door for a discussion of regional impact analysis, several problems invariably arise. Not the least of these is the matter of regional definitions and delineations. To an important extent, what is a region for one purpose may not be a region for another. River basins, for instance, represent an appropriate way to regionalize the country if the analytical problem involves water resources, but because river basins often transcend political jurisdictions, they do not always constitute a meaningful unit of analysis for policy and management. At the other extreme, states and their political subdivisions represent policy and management units but are often not coexistent with regions that make ecological or economic sense. Hence, any one system of regionalization requires some forced fitting. Since the state is the basic regional unit for data collection, it may be the best (albeit, an imperfect) unit for regional analysis of environmental impacts.

Another problem for regional analysis arises when a particular action appears to be in the national interest but not in the interests of one or more regions (i.e., states). The problem is one of distribution and it is a classical economic problem for which there is no consensus solution. Yet, the fact that no objective formula exists

for evaluating regional versus national tradeoffs does not negate the need to be aware of such tradeoffs. In some cases, if the divergence of interests is known, suitable schemes for compensation and cost-sharing can be worked out.

The question then arises: What is the best way to assure that regional interests are noted in the EIS? Federal attempts to use the central government to uncover divergences in regional and national interests risk overlooking features of a regional environment which may be so subtle as to escape note by those not intimately familiar with the region in question. Attempts to use large-scale models (such as SEAS) often fail for this reason. Analysts in each state, who are familiar with the physical, social, economic and cultural environment, stand a better chance of doing a thorough and rapid analysis. Consequently, there is something to be said for a system of EIS review which vests in the various states primary responsibility for calling attention to adverse regional impacts of a proposed federal action. There is ample precedence for such a system. The Corps of Engineers has long submitted proposals for major construction as well as applications for various permits to state authorities for review and comment.

Environmental Assessments

So far, the discussion has concentrated on the EIS proper. An environmental assessment (EA) is intended to determine which actions require an EIS /1, pp. 16-20/. Any attempt to improve the EIS process should start with the EA. The EA can provide an initial checklist of items to be considered.

A sample checklist is attached. There is no reason why the checklist should be identical for all agencies. Further, while the specific items included in the checklist are only illustrative of the kinds of questions that ought to be addressed, the format of that checklist, requiring that impacts be identified as to their duration and that possible differential regional impacts be noted, is significant.

The significance stems from the fact that the checklist format permits the use of a general formula to weight the results of the checklist evaluation and determine whether or not an EIS is required. While a formula will not be developed here, some of its properties will be discussed.

In general, a formula can be written to determine the expected "mean impact" on any number of environmental variables of a proposed action. Thus, the same formula could be used with different checklists and serve to simplify the evaluations of EAs from different agencies.

The development by CEQ of a general checklist with specific needs of agencies subject to negotiation, a weighting formula and guidelines for their use would greatly simplify and accelerate the EA process.

Summary and Conclusions

There is growing recognition that the instruments used by the federal establishment to evaluate proposed government activity should facilitate closer scrutiny of the potential tradeoffs involved in alternative courses of action. The EIS process has considerable potential for interjecting more rational decision-making into federal programs. This paper suggests the following changes to improve the EIS as a decision tool. (1) Provide a rational structure to the EIS, one that will give it more focus and force explicit consideration of a range of alternatives; (2) use B/C analysis; (3) develop greater methodological consistency; (4) give the states a more active analytical role so as to assure that differential regional impacts are not ignored; and (5) improve the environmental assessment procedure to determine when an EIS is required.

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5. Mishan, E.J., Cost-Benefit Analysis, Second Edition (London: George Allen & Unwin, 1975).

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Worksheet for Environmental Assessment

QUESTION: Based on the best informed judgment, is there any reason to believe the proposed action will significantly:	Duration				Differential Regional Impacts
	Transitory	Short-run	Long-run	Irreversible	
1. Cause ambient air quality to be reduced in one or more ways?					
2. Cause climate to change?					
3. Cause the quantity of surface water to change?					
4. Cause the quality of surface water to be reduced in one or more ways?					
5. Cause the supply of ground water to be reduced?					
6. Cause the quality of ground water to be reduced in one or more ways?					
7. Cause one or more species of flora to be endangered?					
8. Cause one or more species of fauna to be endangered?					
9. Cause the physical terrain (over more than 100 acres) to change?					
10. Impinge in any way upon a recognized historical structure or landmark?					
11. Reduce the capacity of any transportation facility?					
12. Increase the use of any transportation facility beyond its design capacity?					
13. Impair the capacity of existing energy facilities?					
14. Increase energy demand from fossil fuels?					
15. Impair the existing capacity or increase the use of facilities used to provide health, education and other public services?					
16. Disrupt operations and activities of museums, religious institutions and/or charitable organizations?					
17. Impair the existing capacity or increase the use of parks, recreational facilities and public assembly areas?					
18. Cause the location, size, and operations of shopping and industrial centers to change?					
19. Impinge on existing single or multi-family residential neighborhoods?					
20. Induce residential development in areas now devoted to open space?					
21. Induce shifts of land out of agriculture?					
22. Cause the productivity of labor to increase at lower rates?					
23. Induce changes in the volume and/or mix of goods and services produced and marketed by the economy?					
24. Induce changes in the market price of one or more goods or services?					
25. Increase the level of unemployment for one or more socio-economic groups?					
26. Increase the crime rate?					
27. Induce changes in the human birth rate?					
28. Increase human mortality?					
29. Increase human health and medical costs?					
30. Increase real per-capita income?					
31. Increase the percent of the population living in urban areas?					
32. Cause an increase in the level of taxation?					
33. Cause changes in the incidence of the burden of taxes among socio-economic groups?					
34. Increase the solid waste and garbage disposal problems of society?					
35. Increase U.S. dependence on foreign sources of supply of raw materials?					

APPENDIX C

STUDIES ON NONDETERIORATION OF AIR QUALITY

An Annotated Bibliography

Prepared by the Commerce Department
Regulatory Policy Committee

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INTRODUCTION

The issue of nondeterioration of air quality has been widely discussed and debated. Because of the widespread interest in this issue and because a synopsis of the major studies on the subject is not available in convenient form, this brief survey of the literature has been prepared as a source document. It contains a summation of findings to enable the reader to gain a broader perspective of this complex issue--and of the extent to which important elements of uncertainty remain with respect to key elements of the debate.

This survey of the literature makes no claim to being exhaustive. To the extent possible, the major studies have been included. This is a factual report on their findings and their derivation.

The report is in three sections. Section I provides an overview of the studies. Section II contains summaries of the studies. Section III is a bibliography.

I. OVERVIEW

Seventeen studies are covered in the individual summaries contained in Part II of this report.

- These analyze six Senate proposals and five House proposals made during the period 1975-1976, as well as earlier proposals.

- Of the 17 studies, nine are basically technical analyses, four are economic analyses, and four are both technical and economic analyses.

- Some analyses are based on actual plants in specific locations; other analyses are based on "model" plants in generalized locations. "Model" plants vary as approximation to actual plants.

- Geographically, the analyses attempt to cover the implications of nondeterioration for the following localities:

Colorado	Boston
Florida	Dallas-Fort Worth
Iowa	Four Corners
Maine	"East"
Minnesota	"Central"
New Mexico	"West"
Texas-Louisiana	Rural Areas
West Virginia	Urban Areas
Wisconsin	Regions, General

- The analyses cover 11 major industrial sources and industry in general. This is only part of the industry source coverage, as shown in Table 1.

- The analyses cite a number of factors which enter into considerations of the impact of nondeterioration proposals. These are the major ones:

  Industry factors

  Size of plant
  Location of plant
  Configuration of plant
  Energy source and use
  Stack height
  Water and raw material availability

Regional factors

Meteorological considerations
Terrain
Background emissions
Dispersion patterns
Availability of land

Individual studies vary in the extent to which these factors are taken into account.

- The assumptions, methodologies, and analytical measures of impact vary widely between the studies.

  - Methodologies used include model plants, state of the art air diffusion models, and cartographic analysis using the "buffer zone" concept.

  - Impact measures used include dollar cost estimates of compliance with nondeterioration, calculation of the number of years an industry's historical growth can continue, determination of constraints on plant size and location, and cost estimates of plant size reduction or plant relocation.

- The wide differences in methods and objectives in most cases preclude comparisons between the studies and prevent putting together an overall picture. However, certain conclusions are common to many of the studies.

  - Class I areas, including "buffer zones," appear to be a major obstacle to economic growth for the industries analyzed.

  - Capital costs required to meet the nondeterioration regulations are higher than the Clean Air Act requirements without nondeterioration requirements.

  - Nondeterioration requirements will necessitate the use of smaller size plants, the installation of additional control technology, the construction of taller stacks, the relocation of plants at alternative sites.

  - Future growth opportunities will be restricted without a Class III designation or a variance from Class II requirements.

- These studies have contributed valuable insights on the technological and economic ramifications of nondeterioration proposals. In the process of doing so, they have shown the difficulties involved in developing an overall assessment. They point out the gaps in knowledge and point the way to completing the necessary industrial and regional analyses which would fill the gaps.

TABLE I

MAJOR SOURCE COVERAGE OF STUDIES

List of 28 Major Sources in S.3219	Source Studied, Not Studied	Bibliography Number	Scope of Analysis: Technical-T Economic-E	National-N Regional-R
1. Fossil-fuel fired steam electric plants	Studied	2,4,6,7,8,9,10, 11,14,15,16,17	T,E	N,R
2. Coal cleaning plants	Not Studied			
3. Kraft pulp and paper mills	Studied	4,5,16	T	N,R
4. Portland Cement plants	Studied	7	E	R
5. Primary zinc smelters	Studied	12	T	N
6. Iron and steel plants	Not Studied			
7. Primary aluminum ore reduction plants	Not Studied			
8. Primary copper smelters	Studied	7,12,16	T,E	N,R
9. Municipal incinerators	Not Studied			
10. Hydrofluoric acid plants	Not Studied			
11. Sulfuric acid plants	Not Studied			
12. Nitric acid plants	Not Studied			
13. Petroleum refineries	Studied	1,16	T,E	N
14. Lime plants	Not Studied			
15. Phosphate rock processing plants	Not Studied			
16. Coke oven batteries	Not Studied			
17. Sulfur recovery plants	Not Studied			
18. Carbon black plants	Not Studied			
19. Primary lead smelters	Studied	12	T	N
20. Fuel conversion plants	Studied	1,16	T,E	N
21. Sintering plants	Not Studied			
22. Secondary metal production facilities	Not Studied			
23. Chemical process plants	Not Studied			
24. Fossil-fuel boilers	Studied	4	T	R
25. Petroleum storage and transfer facilities	Not Studied			
26. Taconite ore processing facilities	Not Studied			
27. Glass fiber processing plants	Not Studied			
28. Charcoal production facilities	Not Studied			

MAJOR SOURCE COVERAGE OF STUDIES (Continued)

Major Sources Not Listed in S.3219	Source Studied, Not Studied	Bibliography Number	Scope of Analysis: Technical-T Economic-E	National-N Regional-R
Coal mining	Studied	3,7,9	T,E	N,R
Oil and gas extraction	Studied	9	T,E	N
Industries, generally	Studied	2,4,7,13	T,E	N,R

II. SUMMARIES OF STUDIES

Individual summaries are on following pages.

Bonner & Moore Associates, Inc. "An Estimate of the Impact of Significant Deterioration Regulations on the U.S. Refining Industry and Related Industrial Growth." January 19, 1976. A report prepared by Franklin P. Frederick for The American Petroleum Institute.

Purpose:

Analysis of the impact of the significant deterioration proposal contained in Senate Working Print No. 6, December 22, 1975, on petroleum refining and oil shale processing.

Assumptions:

- Factors are specific to local situation.
- Plants will relocate in inland Texas.
- Plant capacity increases will be proportional to current capacity distribution.

Methodology:

- Small refineries are compared with large refineries.
- Cost comparisons are based on industry rule of thumb - power series equation relating plant capacity and capital cost.
- Mapping of available sites under various dispersion limits indicates available industrial areas.
- Assesses coal and oil shale sites relative to development in or near Class I areas.
- Uses dislocation cost model to calculate investment required to relocate plants in Texas.

Conclusions:

- Retardation and restriction of major U.S. refining growth.
- Precludes near-term utilization of large quantities of oil shale.
- The cost of utilizing coal reserves will increase.
- Compliance cost for refineries would be about 10 percent of the total cash flow.

- Production costs of refineries would increase due to:
  - Reduction in plant capacity.
  - Necessity to use stringent control technology.
  - Location of new plants at less advantageous sites.
- Dislocation of planned industrial plants to non-impacted regions to meet 1985 demand growth would cost $640 million to $1.18 billion in capital investment (in 1975 dollars).
- The regulations will affect energy independence.

Environmental Research and Technology, Inc. "An Evaluation of Proposed Regulations on the Prevention of Significant Deterioration of Air Quality: Implications for New Power Plants and Other Point Sources of Air Pollutants." July 14, 1975.

Purpose:

To examine the effect of strict interpretations of proposed significant deterioration regulations contained in Senate Working Print No. 3, August 8, 1975, on the development of reasonably sized new facilities in Class II regions, particularly those where the local terrain is hilly or mountainous.

Assumptions:

- Increments as ratios of National Ambient Air Quality Standards (NAAQS):
  - SO_2 . . . . Annual . . . . . 19 percent
  - SO_2 . . . . 24-hour. . . . . 27 percent
  - SO_2 . . . . 3-hour . . . . . 54 percent
  - TSP*. . . . Annual . . . . . 13 percent
  - TSP*. . . . 24-hour. . . . . 12 percent

  * Total Suspended Particulates (TSP)
- New Source Performance Standards (NSPS): 1.2 lbs. SO_2 per million BTU heat input; 0.1 lbs. TSP per million BTU heat input.
- 500 megawatt coal-fired powerplant.
- Stack height--500 feet.

Methodology:

- Parameters used in calculations were representative of New Mexico and West Virginia.
- Flat and hilly terrains were considered:
  - Hilly: West Virginia--rise of 1,000 feet in 6 kilometers.
  - Moderately hilly: New Mexico--rise of 1,000 feet in 10 kilometers.

- Meteorological data:

  - Southwest: From Tulsa, Oklahoma.

  - West Virginia: From Pittsburgh, Pennsylvania

- Coal Analysis:

  - New Mexico: 0.7 percent sulfur.

  - West Virginia: 2.1 percent and 0.7 percent sulfur.

- The EPA/CRSTER model was used to calculate SO_2 and TSP concentrations in the vicinity of the powerplants. The model computes hour-by-hour concentrations for an entire year, taking into account terrain variability around the source.

Conclusions:

- In flat terrain a 2,000 megawatt powerplant can operate with NSPS emissions without exceeding Class II guidelines.

- In hilly or mountainous terrain, only a small plant can operate within the Class II guidelines; e.g., in New Mexico the maximum size was calculated to be 158 megawatts, an inefficient size for a new facility. In very hilly West Virginia, 49 to 64 megawatt plants would be the maximum size.

- SO_2 guidelines are more restrictive than TSP for fossil fueled combustion.

- Using a scrubber in addition to low sulfur coal in New Mexico, the maximum capacity in hilly country increased from 158 megawatts to 216 megawatts.

- In West Virginia, using 2 percent sulfur coal typical of the region, and using scrubbers operating 90 percent of the time, the maximum conforming plant is 38 megawatts.

Environmental Research and Technology, Inc. Impact of Significant Deterioration Proposals Upon Western Surface Coal Mining Operations. ERT Document P-2125-1. April 14, 1976. A report prepared for The Federal Energy Administration.

Purpose:

Assess the impact of current proposed amendments (Senate Bill No. 3219, House Bill No. 10498) to the Clean Air Act on western strip mining, with particular attention to impacts resulting from fugitive dust emissions. Study analyzes impacts at six mines in northwestern Colorado.

Assumptions:

- Total ambient 24-hour and annual average concentrations were based on mining activity plus estimated background concentrations.
- Baseline concentrations of Total Suspended Particulates (TSP) for mine vicinity assumed to be similar to other rural western regions.
- National Ambient Air Quality Standards (NAAQS) and nondeterioration regulations do not apply to company-owned property.

Methodology:

- Emissions from mines are estimated from emission factors for total suspended particulates and adjusted to apply to individual mines.
- TSP concentrations were calculated by the ERTAQ model, a Gaussian dispersion model.
- ERTAQ runs examined multiple sources and meteorological conditions and average concentrations from many sources over long time periods.
- Required meteorlogical data were obtained from weather stations nearest each mine site.
- Twenty-four-hour and average annual TSP concentrations at several downwind distances from each mine site were compared with primary and secondary NAAQS and significant deterioration requirements.

Conclusions:

- Conflicts with nondegradation regulations will have to be countered by providing a sufficiently wide company-owned protective buffer zone between the actual mining site and non-company-owned property.

- For Air Quality Control Region's (AQCR) where more than one strip mine is proposed, the ambient background TSP concentrations may exceed the primary NAAQS standards. The proposed amendments would therefore prohibit new surface mining operations in such AQCR's.

- At larger mines, NAAQS secondary standards can be exceeded at distances within one kilometer.

- Class II TSP increments would impose strong constraints on mining up to property lines. A buffer zone of approximately five kilometers in all directions from a typical mine would be needed in order to maintain ambient air quality.

- Class I 24-hour maximum increments could be exceeded out to distances of 15 kilometers from a larger mine.

Environmental Research and Technology, Inc. Proposed Clean Air Act Amendments: Implications of Nondeterioration Rules on Maine. ERT Document No. P-1992, August 28, 1975.

Purpose:

Evaluate the proposed rules for air quality maintenance planning and for prevention of deterioration of air quality, as contained in Senate Staff Working Print No. 3, dated August 8, 1975.

Assumptions:

- Kraft pulp and paper mills will burn oil and discharge all emissions through a single 300-foot tall stack. Evaluated for three terrain configurations:
  - gentle: 2 percent slope.
  - moderate: 4 percent slope.
  - hilly: 6 percent slope.
- Coal-fired powerplant evaluated for a 2 percent slope.
- Package boiler system evaluated for perfectly flat terrain using 2.5 percent sulfur content oil.

Methodology:

- The analysis is technical - a determination of siting potential for industrial facilities through air quality diffusion modeling in the state of Maine.
- Model plants are specified:
  - 1,000 ton per day Kraft mill.
  - 500 megawatt electricity generating plant.
  - 11,000 BTU per hour package boiler suitable for large apartment building or small industry.
- Plant design engineered to minimize air quality impact and to comply with New Source Performance Standards.
- EPA/CRSTER model applied to model plants to predict the impact of point source pollutant emissions on ambient air quality.

- CRSTER parameters modified to reflect Maine topography and meteorology.

- Use of "buffer zone" concept to determine areas suitable for industrial development.

Conclusions:

- Elimination of Class III areas precludes states from designating limited areas preferred for industrial development.

- Substantial size buffer zones are necessary around Class I areas. A Kraft mill requires a 90-mile buffer zone. A 500 megawatt powerplant requires a 120-mile buffer zone.

- Major sources located in hilly or mountainous terrain will have difficulty in complying with Class II requirements.

- A single tall stack may facilitate compliance with Class II requirements. However, this may increase concentrations far from the source and thereby force location at a greater distance from Class I areas.

- Enforcement would preclude industrial development being based on efficiently sized facilities. Maximum powerplant size in areas of gentle slope would be 400 megawatts.

- Industrial development in Maine would be more severely restricted than in many other states. The presence of hilly or mountainous terrain and the potentially large number of Class I areas would exclude industrial development in many parts of Maine.

Environmental Research and Technology, Inc. Proposed Clean Air Act Amendments: Implications of Proposed Rules for Nondeterioration of Air Quality on the Construction of Kraft Pulp and Paper Mills. ERT Document No. P-1967, September 9, 1975.

Purpose:

Evaluate the proposed rules for the prevention of significant deterioration of air quality contained in Senate Staff Print No. 3, dated August 8, 1975.

Assumptions:

- Kraft pulp and paper mills will discharge all emissions through a single 300-foot tall stack.
- Kraft mill energy requirements will be met by one of four fuel configurations for on-site generated power or off-site purchased power. The fuels used are:
  - Coal.
  - Oil.
  - Coal and bark.
  - Oil and bark.

Methodology:

- The analysis is technical--a determination of siting potential of Kraft pulp and paper mills through air quality diffusion modeling.
- A model 1,000 tons per day Kraft mill is specified. Model plant complies with New Source Performance Standards.
- Model plant is located at five specific sites which might reasonably be used for a new Kraft mill. The sites have the appropriate mix of resources necessary for a Kraft mill --forest lands, water, transportation, and market conditions. The sites selected are in the states of Pennsylvania, Tennessee, Alabama (two sites), and Montana.
- EPA/CRSTER model (modified CRS-1 program) applied to model plant to predict the impact of plant emissions on ambient air quality.
- CRSTER parameters modified to reflect actual terrain and meteorology for each of the five sites.

Conclusions:

- At two of the five sites, sulfur oxide increment limits for Class II would severely restrict the capacity of a coal-fired mill. If allowed to use the whole increment, such mills would be limited to 318 tons per day capacity. Oil and bark-fired mills and mills purchasing power off-site could have a maximum capacity of less than 700 tons per day.

- At two other sites, again using the whole Class II increment, capacity would be limited to 420 tons per day to 1,000 tons per day, depending upon the energy configuration.

- At the fifth site, conditions of almost flat terrain permit construction of mills with capacities of 1,000 tons or more per day.

- Coal-fired mills generally would be restricted to smaller capacities than oil-fired mills. Areas with a land slope greater than 2 percent generally would be restricted to smaller capacity.

- A "buffer zone" is required to prevent Class I intrusions. A worst case analysis for the five sites finds that for:

  - Libby, Montana: Maximum plant capacity 318 tons; buffer zone 48 miles.

  - Oil City, Pennsylvania: Maximum plant capacity 431 tons; buffer zone 60 miles.

  - Huntsville, Alabama: Maximum plant capacity 518 tons; buffer zone 72 miles.

  - Montgomery, Alabama: Maximum plant capacity in excess of 1,000 tons; buffer zone 66 miles.

Florida Power and Light Company. "Impact of Federal Clean Air Legislation on the Citizens of Florida." May 5, 1976.

Purpose:

Assess the cost impacts to customers of Florida Power and Light Company as a result of proposed significant deterioration amendments.

Assumptions:

- Electric energy will supply an increasing share of nation's energy needs.
- Installation costs of a nuclear unit will range from $1 to $1.25 billion.
- Capital cost of a coal unit ranges from 75 percent to 85 percent of the capital cost of a nuclear unit.

Methodology:

- Cost of compliance with significant deterioration proposals determined by estimating current cost of power plant construction and assuming a 6 percent cost increase over 7 to 9-year construction schedule.

Conclusions:

- Significant deterioration proposals will add $120 to $300 million to costs of electricity supplied to Florida Light and Power Company customers.
- Proposed clean air legislation will increase the cost of coal-fired energy units and may prohibit location of these units in some areas of southern Florida.

Harbridge House, Inc. The Impact of Proposed Non-Degradation Regulations on Economic Growth. Volumes I-III. October-November 1973. A report prepared for The U. S. Environmental Protection Agency. (Only Volume I, October 1973, available for summarization.)

Purpose:

Assess the impact of proposed significant deterioration proposals as of 1973, on:

- Regional and economic growth in Boston, Massachusetts; Iowa; and Four Corners region.
- Economic growth in industries identified as major sources of SO_2 emissions.

Assumptions:

- Not specified.

Methodology:

- Analyzes two of the proposed alternative significant deterioration regulations. Alternative I proposes a nondegradation program to control ambient air quality through the addition of a third level of restrictions beyond primary and secondary standards. Alternative II proposes an emission limitations plan.
- Methodology and data are presented in Volume II, which was unavailable.

Conclusions:

- Regional growth impacts:
  - Boston: Alternative I would allow projected growth in metropolitan Boston, particularly on the north and south shore. Alternative II would only permit approximately 20 percent of projected growth.
  - Four Corners: Under Alternative I, proposed powerplants could be built but copper smelters and cement plants would be prohibited. Under Alternative II, all proposed growth would be allowed.
  - Analysis is incomplete for Iowa. Data was inadequate to assess impact of Alternative I and II on economic growth in Iowa.

- Industry impacts:

  - Total increase in employment through 1980 is 105,000 for industries that have major SO_2 and Total Suspended Particulates emissions.

  - Full development of coal resources for mine mouth power generation will be restricted under both alternatives.

- National impacts:

  - On balance, Alternative I would allow more economic growth than Alternative II.

  - Alternative I would force a direction of growth to generally suburban and rural areas.

Hoffman, David W. and Bechthold, James L. "Impact Analysis of the Effect of Proposed Clean Air Act Amendments and Existing EPA Significant Deterioration Regulations on Electric Utilities in Minnesota and Wisconsin." November 14, 1975 (revised November 25, 1975).

Purpose:

Presentation and analysis of November 1975 House and Senate draft Clean Air Act Amendments and current EPA guidelines for nondegradation as they affect utility siting in Minnesota and Wisconsin.

Assumptions:

- No quantitative economic assumptions.
- Maximum number of areas will be classified as Class I areas.

Methodology:

- Collected existing air quality data for the Air Quality Control Region's of both states.
- Matched existing air quality against increments permitted by all plans, including more stringent State Implementation Plans.
- Used mapping method to identify potential utility sites vis-a-vis "buffer zones" and Mandatory Class I areas.

Conclusions:

- Impact on both Minnesota and Wisconsin would be severe in terms of the siting of new powerplants and providing electricity for new industries in these states.
- For Minnesota:
  - The impact of the Senate Mandatory Class I area would be most significant in northern Minnesota. Similar results occur with the House version.
  - The full Senate Class II annual increments can be used for most of the State. The House Class II does not allow 47 percent of the areas full use of the increment.
  - The House Class III (24-hour) curtails growth in 47 percent of the area.

- The Senate 3-hour increment allows partial growth in 50 percent of the Class II sites and 25 percent of the sites cannot have any development.

- The 24-hour standard (SO_2) is more restrictive than the 3-hour standard due to the travel distance of the pollutant.

- For Wisconsin:

  - Under EPA guidelines, there are no Mandatory Class I areas in Wisconsin. However, there are many wildlife refuges, national forests, wild and scenic rivers and Indian reservations. It can be expected that some of these areas will be designated as Class I.

  - Assuming the maximum possible area which could be designated as Class I, most of the State of Wisconsin would be included in a Class I region or its buffer zone.

  - The 24-hour standard is more restrictive than the annual average for both SO_2 and Total Suspended Particulates (TSP).

  - TSP are not as restrictive as those in Minnesota due to the existing ambient air quality.

  - Seventeen of 34 sites would not be allowed growth due to TSP limits in Senate version.

  - Twenty-four of 39 locations would be excluded from development.

ICF Incorporated. Issues and Impacts Associated with Proposed Prevention of Significant Deterioration and Nonattainment Amendments of the Clean Air Act. May 28, 1976. A report prepared for the Federal Energy Administration.

Purpose:

Assess the impact of the proposed nondeterioration proposals and related provisions under consideration by the House and Senate as amendments to the Clean Air Act. Specifically, assess the impact of nondeterioration on rural areas currently complying with National Ambient Air Quality Standards (NAAQS), urban areas not in compliance with NAAQS, and on industries which face specific problems due to other provisions.

Assumptions:

- Siting analysis based on a 60-mile buffer zone per 1,000 megawatt powerplant meeting New Source Performance Standards (NSPS).

- Best Available Control Technology (BACT) is assumed to reduce buffer zone requirements by a factor of ten.

- Twelve computer runs were made to assess energy and economic effects. These were based on three sets of sulfur emission limitations under two alternative assumptions of oil use and two alternative assumptions concerning a nuclear moratorium.

  - The sulfur limits are:

    1) NSPS under the current Clean Air Act.

    2) Scrubbers on low sulfur coal in the West and on high sulfur coal in the East.

    3) Scrubbers on low sulfur coal in both the East and the West.

  - Oil burning

    1) No restriction.

    2) Oil use restricted to peak load generating capacity.

  - Nuclear

    1) No moratorium.

    2) Moratorium.

- The assumptions underlying the Federal Energy Administration's energy model (PIES) were not presented.

Methodology:

- The analysis is technical and economic. The economic analysis appraises direct impacts on industries, regions, and consumers.
- Analyses siting potential for new major emitting sources based on cartographic analysis using the "buffer zone" concept to reflect air diffusion requirements.
- Assesses energy and economic effects of nondeterioration by use of the PIES model. The model's structure is not presented.
- Impact assessment is based on changes in:
  - Current siting potential.
  - Oil imports, oil used for electric power, and coal production.
  - Capital and annual costs incurred by utilities.
  - Electric power consumption and prices.
  - Sulfur emissions.

Conclusions:

Rural Areas

- Economic development is not precluded in rural areas.
- But, rural area development will be higher in cost due to:
  - Added control requirements.
  - Not locating plants where they would otherwise have been located.
  - Plants would be built smaller than otherwise.
  - Other responses to the provisions.
- For electric utilities:
  - By 1990, oil consumption would increase by one million barrels a day (MBD) of largely imported oil.

- Over the period 1980 to 1990, capital costs would increase by $6 to $17 billion, $6 billion if oil use is permitted and $17 billion if oil use is prohibited.

- Cost to consumers in 1990 would increase from $100 to $300 million per year. The impact in terms of percent increase in consumer costs would vary between regions. The increases would range from minimal to 4 percent initially, increasing as old plants are retired to a maximum of 20 percent.

- Allowing increases in oil consumption could reduce coal production by up to 150 million tons per year. Output reduction would occur in the West.

- In 1990, sulfur emissions would be reduced from minimal to 10 percent.

- A nuclear moratorium would exacerbate the adverse impacts.

Urban Areas

- Under the proposed amendments, economic development and employment in urban areas violating NAAQS would not increase. This is attributable to the current Clean Air Act, not the pending amendments.

- Nondeterioration provisions may result in the siting of new facilities further from urban centers than would otherwise occur. This would tend to contribute to further urban sprawl, a lengthening in job travel time, adverse environmental effects, and other socio-economic effects.

Other Problems

- Natural events which degrade air quality, e.g., dust storms, could preclude development of energy and material resources, such as oil shale, coal, and copper.

- Oil field development (such as tertiary recovery) could be inhibited by nondeterioration provisions.

- Procedural requirements could add more than one year to economic and energy development.

- The "steel industry amendment" might help steel and some other industries. Conversely, the amendment could hinder development in most industries by precluding development in dirty urban areas.

National Economic Research Associates, Inc. "Estimated Costs for the Electric Utility Industry of Nonsignificant Deterioration Amendments Currently Considered by the United States Senate." Preliminary Draft, April 16, 1976. A report prepared by Lewis J. Perl.

Purpose:

Assess the cost to the electric utility industry and consumers, nationally and by region, of the March 29, 1976, Senate nondeterioration proposal.

Assumptions:

- Demand for electricity will grow 5.5 percent per year.
- New capacity will be roughly half coal and half nuclear.

Methodology:

- The analysis is technical and economic. The economic analysis assesses the direct economic impacts on industry capital, operating and maintenance cost needs, and consumer budgets.
- Air quality modeling, computer simulation, and econometric projections utilizing model plant configurations.
- Model plants -- five sizes designed for least cost sulfur oxide emission control. Plants accepted or rejected on original design capacity, i.e., additional hardware was not added if the significant deterioration increment was violated.
- Decision to reduce capacity at a site or relocate at new site (for a new plant) considered foregone economies of scale, transmission line costs and any differences in capital and operating and maintenance costs.
- Regional impact estimates based on cost of model plants meeting the constraints in the region.
- Household estimates based on extrapolation of Census data using a compounding annual growth rate equal to the annual growth rate in the state or region, 1950-1973. These results then scaled to the 1985 and 1990 overall estimates.
- Impact assessment is based on changes in:

  - Industries 1990 revenue requirement.

- Cumulative revenue necessary over the period 1975-1990.

- Cumulative capital requirement over the period.

- Industry demand for low-sulfur coal.

All impact comparisons are based on 1975 dollars.

Conclusions:

- In the absence of nondeterioration, the Clean Air Act will cost each American's household $1,500 between 1975-1990.

- Amendments in S.3219 add $299 per household to the above. If extreme interpretations are made and demand growth is high, then S.3219 could add $673 per household.

- The economic impact per household varys greatly between regions. Texas is the highest cost region. Over the period 1975 to 1990, cumulative cost per household under the Clean Air Act in Texas is $1,765, compared with $685 for the average U.S. household. Nondeterioration adds $860 in the same period for Texas, compared with $210 for the average U.S. household.

- The electric cost per household between different regions "indicates the extremely disparate regional effects of the legislation. To the extent these costs are passed on to industrial customers regionally, they are likely to discourage the expansion of electric-intensive industries in high cost areas, and, as a consequence, adversely affect employment and economic growth in those regions."

- Sulfur coal supplies are believed inadequate to meet industry needs under S.3219.

National Economics Research Associates, Inc. "An Analysis of the Costs of the Electric Utility Industry of House and Senate Significant Deterioration Proposals." December 12, 1975. A report prepared by Lewis J. Perl and Thomas K. Fitzgerald.

Purpose:

To evaluate the costs incurred by the electric utility industry from SO_2 control under alternative policy options contained in the House (October 8, 1975) and Senate (September 4, 1975) proposals.

Assumptions:

- Best Available Control Technology (BACT) is met by compliance with New Source Performance Standards (NSPS).
- BACT is met by compliance with NSPS plus Flue Gas Desulfurization (FGD), and the use of 1 percent sulfur coal in the West and 1-2 percent sulfur coal in the East.
- Assumptions regarding additions to capacity, 1975-1990:
  - 1990 sales assume 5-6 percent growth, 1973-1990.
  - No oil or gas additions, 1980-1990.
  - Coal and nuclear additions are sufficient to reach 1990 capacity.
  - Hydro-electric, Pump Storage, Internal Combustion and Gas Turbine capacity growth is two-thirds the growth rate of 1974-1980 period.
  - High growth case assumes equal additions of coal and nuclear capacity; low growth assumes nuclear capacity of 300,000 megawatts by 1990, with coal making up the remainder.
  - Capacity by fuel type in 1980 is based on planned additions, 1974-1980.

Methodology:

- The size distribution of capacity additions was projected from historical trends.
- Five model plants are designed so as to comply with the sulfur emission requirements of the four nondeterioration proposals. The design incorporates a 500-foot stack.
- Capital, fuel, other operating and maintenance costs, and annual costs are estimated for the five sizes of plants. The costs are in 1975 dollars.

- Average plant cost is modified in a NERA program to reflect individual site needs for compliance with sulfur emission standards. The NERA program chooses the lowest cost option from among scrubber and non-scrubber alternatives, given the quality of coal available to plants.

- Plants unable to meet standards are relocated or reduced in capacity.

Conclusions:

- Cumulative capital costs to 1990 in 1975 dollars:

  - Base capital costs=$600 to $834 billion, 1975-1980.

  - Clean Air Act compliance costs add $37 to $54 billion, a 6.2 percent to 6.5 percent increase.

  - Senate: BACT=NSPS adds $7 to $15 billion to compliance costs, an 18.6 percent to 27.3 percent increase.

  - House: BACT=NSPS adds $6 to $13 billion, a 16.9 percent to 34.8 percent increase.

  - If BACT=NSPS+FGD, capital costs may rise above Clean Air Act costs by $8.7 to $18.6 billion, that is, 23.4 percent to 34.3 percent.

  - Compliance with significant deterioration regulations would add from 9.2 percent to 31 percent to annual Clean Air Act costs.

- Low-Sulfur Coal Demand:

  - The Clean Air Act would increase demand for low-sulfur coal by 36.8 percent to 44.5 percent by 1990.

  - House and Senate amendments would change this by -4.8 percent to +13.4 percent. The less restrictive BACT variant would result in a decrease in demand for low-sulfur coal, while the more restrictive BACT variant would lead to increased demand.

- Scrubbers:

  - Under the Clean Air Act, 160,597 megawatts to 217,931 megawatts of scrubbers would have to be installed. Under less restrictive BACT, this would increase by 44,000 megawatts to 103,000 megawatts. Under more restrictive BACT, this would increase by 56,000 megawatts to 127 megawatts.

- Other problems are associated with compliance:
  - Uncertainty of scrubber reliability.
  - Uncertainty as to commercial feasibility of using regenerative scrubbers with low-sulfur coal.
  - Increased supply of sulfuric acid and consequent marketing problems; increased direct cost os SO_2 removal.
  - Substantial volumes of sludge, and associated storage and disposal problems.
  - Electric power rate problems, such as the effect of failure to raise rates on the ability of industry to raise capital.

U. S. Department of Commerce, Bureau of Domestic Commerce. "An Analysis of the Impact of Alternative Approaches to Significant Deterioration in the Non-Ferrous Metals Industry." Staff Study A-03-76, April 1976.

Purpose:

Compare the impact of EPA regulations and current House and Senate nondegradation proposals on the non-ferrous smelting industry and translate these impacts into quantitative restraints on growth in this industry. Analysis limited to copper, zinc, and lead smelters.

Assumptions:

- Future growth, both for new facilities and incremental expandion at existing smelter sites, will follow the pattern and composition of the current non-ferrous smelting industry.

- Growth increments are supply-based and are stated as percentage increases using existing capacity as a base.

Methodology:

- Only SO_2 air pollution restrictions of the nondegradation proposals are analyzed. Restrictions on particulate emissions are not significant to this industry.

- Smelter configurations, pollution abatement equipment installation data, dispersion patterns and pollutant emission measurements are based on recorded company data and are consistent with EPA technical information and statistical data.

- Air quality modeling is based on EPA guidelines and utilizes their PTMAX program.

- PTMAX calculations, based on available emission measurements, were made for each smelter stack. Results were compared with proposed increment levels for each area class and impacts on capacity expansion were determined.

Conclusions:

- For all area classes, the House 3-hour and 24-hour proposed increments are more restrictive than EPA and Senate proposed increments.

- No new smelters could be built in Class I areas under the pending proposals.

- Establishment of mandatory Class I areas in effect creates a "buffer zone" between new smelters and the Class I area. This is necessary in order to prevent significant deterioration of ambient air quality within the boundaries of the proposed Class I areas. This "buffer zone" would be approximately 60 kilometers for lead smelters, 30 kilometers for zinc smelters, and 25 kilometers for copper smelters.

- Proposed EPA and Senate 3-hour and 24-hour Class II increments do not significantly restrain construction of new non-ferrous smelters in the short-run. In the long-run, restrains could be substantial.

- Under Best Available Control Technology (BACT), assumed to be equal to New Source Performance Standards (NSPS), expansion of existing non-ferrous smelters would be severely restrained in Class I areas. The restraint is so severe that expansion is practically impossible.

- Under proposed manadatory Class I areas, existing smelters could be forced to relocate or reduce operations to a level that would not cause deterioration of ambient air quality. Both of these alternatives may not be economically feasible because of prohibitive increases in transport costs or adverse economies of scale. The result could be a real reduction in non-ferrous smelting capacity.

U. S. Department of Commerce, Bureau of Domestic Commerce. Implications of Air Non-Degradation Policies on Clean Air Regions: A Case Study of the Dallas-Fort Worth AQCR. May 1974.

Purpose:

Assess the effect of nondegradation on industrial growth in the Dallas-Fort Worth area. (Policy options tentatively proposed on July 18, 1973.) The study covers ten industrial sectors and point and nonpoint sources within the Dallas-Fort Worth Air Quality Control Region (AQCR).

Assumptions:

- Composition of pollutant sources will remain the same over the study period.
- Industrial growth in the Dallas-Fort Worth area will approximate the growth pattern specified in the OBERS and Texas State Planning Commission projections.

Methodology:

- The original Sierra Club plan and three out of four EPA plans were assessed. One plan (Plan III) was not assessed because it was nonquantifiable.
  - Sierra Club plan applies Best Available Control Technology (BACT) to new point sources, requires control of incineration, and prohibits open burning. The plan specifies an ambient air quality standard and an emission standard.
  - EPA Plan I established a maximum allowable increment of additional pollution against a 1972 emission baseline.
  - EPA Plan II limited total emissions in the AQCR to 120 percent of the 1972 baseline.
  - EPA Plan III allowed local or state authorities to decide individually for each new or modified source, whether the resulting pollution is significant.
  - EPA Plan IV was based on ambient air quality as in Plan I, with the addition of a local option to subdivide the controlled area. The subdivided areas were given different permissible deterioration increments. A two-zone case was analyzed. Zone I standards were set so as to achieve essentially no deterioration of air quality. Zone II deterioration increments were set at the same levels as for Plan I.

- State of Texas and EPA pollution emission inventories, Census data, Federal Power Commission reports, private company information, and other sources were used to develop industry by industry estimates of pollutant loading per unit of output.

- Production indices for specific industrial activities were applied to GNP projections of future levels of economic output. The level of output by industry was used to estimate pollutant loadings.

- The EPA/NOAA Climatological Dispersion Model was used for the air diffusion modeling.

- Analysis of the plans was based on the following control scenarios:

  - Industrial sources uncontrolled.

  - Industrial sources control to New Source Performance Standards (NSPS).

  - Industrial sources control to BACT.

  - Industrial incineration controlled.

  - Industrial incineration uncontrolled.

  - Open burning permitted.

  - No open burning permitted.

Conclusions:

- Nonpoint sources contribute almost 60 percent to Total Suspended Particulates (TSP) and SO_2 emissions. Control of these sources is essential to improvement in air quality.

- Retrofit of existing point sources to meet BACT will measurably reduce the rate of increase in SO_2 emissions.

- Natural background emissions of TSP frequently exceed secondary National Ambient Air Quality Standards in urban regions such as Dallas-Fort Worth. Recognition of this must be incorporated into proposed plans.

- Zone I, Plan IV limits would be exceeded by 1980 unless nonpoint sources are controlled.

- SO_2 emissions will not restrict growth under Plan I and Zone II, Plan IV until some time after 1990. Assuming present fuel use patterns and the use of BACT, SO_2 emissions will increase 8 ug/m^3 by 1990. The allowed SO_2 increment is 15 ug/m^3.

- Particulate emissions will curtail growth under all of the EPA plans. Ignoring background particulate emissions, growth will be possible until the early 1990's if BACT is applied to new point sources, incineration is controlled, and open burning is prohibited.

- If, in addition, BACT is applied to existing point sources, the growth period is extended 35 years to year 2010.

- The Sierra Club plan permits growth for approximately 25 years to the mid-1990's when BACT is applied to new point sources, incineration is controlled, and open burning is prohibited.

U. S. Environmental Protection Agency and Federal Energy Administration. "An Analysis of the Impact on the Electric Utility Industry of Alternative Approaches to Significant Deterioration." Vols. I and II. October 1975.

Purpose:

Evaluate the impacts on the electric utility industry of the various approaches to preventing significant deterioration of air quality. Specifically, this analysis estimates the impact on powerplant size and siting of EPA regulations, the Senate discussion draft dated September 8, 1975, and the House discussion draft dated June 16, 1975, as amended by Congressman Heintz' amendments on September 4, 1975.

The following issues are addressed:

- Impact on coal-fired powerplants.
- Implications of Class I designations.
- Impact of alternative Class II increments.
- Implications of stack height limitations.
- Minimum degree of emission control.

Assumptions:

- Two scenarios were studied:
  - High impact.
    a) All plants meet New Source Performance Standards (NSPS).
    b) Mandatory Class I areas.
    c) Allowable stack height--500 feet.
    d) All plants must meet Class I and Class II increments.
  - Low impact.
    a) Plants exceed NSPS technology.
    b) Discretionary and possible Class I areas are designated Class II.
    c) Stack height 500 feet in House proposal and 1,000 feet in Senate proposal.
    d) Some Class III areas in Senate proposal.

- 1,000 megawatt plant size used in analysis.

Methodology:

- Cartographic analysis used to graphically depict land that may be precluded from the siting of 1,000 megawatt powerplants because of degree of required pollution control or those that are identified as Class I areas.

- Analysis of a sample of 74 new coal burning powerplants was undertaken to establish probable impact of alternative significant deterioration proposals. This analysis provided information on land area and projected powerplant capacity that could be affected by the proposals.

Conclusions:

- The Congressional proposals would require most new coal-fired powerplants to control beyond NSPS, construct taller stacks, build smaller plants or relocate.

- Class I area designations primarily impact on siting, plant size and level of pollution control in new coal-fired plants.

- Class I impacts are not geographically uniform. A 1,000 megawatt coal-fired plant meeting NSPS could be built on flat terrain under Class II increments but could not be built on nonflat terrain.

- The use of taller stacks and control beyond NSPS improved the chances that a coal-fired plant will be able to comply with Class II increments in areas of nonflat terrain.

- Redesignation of Class II areas as Class III improves plant siting flexibility.

U.S. Environmental Protection Agency and Federal Energy Administration. "An Analysis of the Impact on the Electric Utility Industry of Alternative Approaches to Significant Deterioration." Supplement Report 2, General Edition: "Analysis of House Discussion Draft Dated October 16, 1975." November 1975.

Purpose:

Supplement the analysis of impacts on the electric utility industry in light of the House Discussion Draft dated October 16, 1975. The changes from the earlier version are in definitions of Mandatory and Discretionary Class I areas.

Assumptions:

- Same as in the original EPA/FEA Impact Report (October 1975) except for redefinition of Class I areas.

Methodology:

- Mandatory Class I areas are limited to national parks and wilderness areas over 10,000 acres. Discretionary Class I areas include national parks, wilderness areas and international parks between 1,000 and 10,000 acres, and national preserves, monuments, recreation areas and primitive areas of over 10,000 acres (i.e., Class I initially with possible reclassification to Class II by the States).

- The number of Mandatory Class I areas is 115, down from 414; the number of Discretionary Class I areas is 86.

- The method of analysis is not specifically stated; presumably the same as in the original EPA/FEA Impact Report (October 1975).

- Two sets of conditions are used for the analysis:

  - Best Available Control Technology (BACT) equals New Source Performance Standards (NSPS).

  - BACT equals NSPS plus Flue Gas Desulfurization (FGD).

Conclusions:

- The land area precluded from siting of 1,000 megawatt powerplants is significantly reduced. If BACT equals NSPS, Class I areas in the western United States are reduced from 91 percent to 69 percent of the land area. If BACT equals NSPS plus FGD, Class I areas are reduced from 39 percent to 12 percent of the land area. In the East, if BACT equals NSPS, the impacted area is reduced from 85 percent to 40 percent.

If BACT equals NSPS plus FGD, the reduction is from 47 percent to 15 percent. In the Midwest, the reductions are 78 percent to 17 percent and 38 percent to 6 percent, respectively.

- The number of mandatory Class I areas is reduced from 414 to 115.

U. S. Environmental Protection Agency and Federal Energy Administration. "An Analysis of the Impact on the Electric Utility Industry of Alternative Approaches to Significant Deterioration." Supplement Report 3 (prepared by Federal Energy Administration): "Further Analysis of House Discussion Draft Dated October 16, 1975." November 1975.

Purpose:

This is an extension of the analysis of the House draft of October 16, 1975. The purpose is to examine the effect of emission standards more stringent than New Source Performance Standards (NSPS) on various sizes of powerplants which use local coal supplies.

Assumptions:

- Three different plant sizes--650, 830, and 1,350 megawatts.
- State and local standards exceed NSPS.
- Emission standards for control beyond NSPS have been adopted by local suppliers who use coal washing and/or Flue Gas Desulfurization (FGD).

Methodology:

- Buffer zones were determined for powerplants of 1,350 megawatt (median size of the total capacity of 74 sample sites), 830 megawatt (median size of all new planned capacity), and 650 megawatt (median size of new capacity additions to sites with existing capacity).
- State and local emission standards stricter than NSPS were considered (down to as low as 10 percent of NSPS).
- A four-region definition of emission standards beyond NSPS is used instead of a two-region definition. The four regions are: East, Central, Texas-Louisiana, and West. The four-region definition takes into account locally available coal in all areas except the West. The western case assumes low-sulfur coal combined with FGD.

Conclusions:

- Under previous analysis based on 1,000 megawatt plants, mandatory Class I areas would preclude powerplant siting on 31 percent of total U. S. land areas when Best Available Control Technology (BACT) equals NSPS and on 6 percent of the land areas when BACT equals NSPS plus FGD. In this supplementary analysis, when BACT equals NSPS, the land areas

precluded from siting equal 32 percent for the 1,350 megawatt plant, 19 percent for the 830 megawatt plant, and 14 percent for the 650 megawatt plant. Where BACT equals NSPS plus FGD, the land areas are 6 percent (1,350 megawatt plant), 4 percent (830 megawatt plant), and 4 percent (650 megawatt plant).

- For mandatory and discretionary Class I areas, the land areas precluded from siting are as follows:

	1,350 Megawatt	830 Megawatt	650 Megawatt
BACT equals NSPS	44%	26%	21%
BACT equals NSPS plus NGD	10%	5%	4%

- The effect on planned capacity in mandatory Class I areas is 16 percent of total site capacity when BACT equals NSPS plus FGD. In the previous analysis, the figure was 18 percent. The effect on planned capacity is 29 percent of total site capacity in mandatory and discretionary Class I areas when BACT equals NSPS plus FGD. In the previous analysis the figure was 37 percent.

U.S. Environmental Protection Agency. "A Preliminary Analysis of the Economic Impact on the Electric Utility Industry of Alternative Approaches to Significant Deterioration." February 5, 1976.

Purpose:

Determine the economic costs to the electric utility industry resulting from the current Senate and House nondeterioration proposals.

Assumptions:

- Three scenarios: Base Case, Nuclear Moratorium, and Energy Conservation. The scenarios assume the following projected growth in demand for electricity for the period 1975-1990: 5.3 percent, Base Case; 5.3 percent, Nuclear Moratorium; and 4.2 percent, Energy Conservation. The scenarios further assume the following projected growth in demand for peak capacity: 5.2 percent, Base Case; 5.2 percent, Nuclear Moratorium; and 4.2 percent, Energy Conservation.

- To meet the most stringent of New Source Performance Standards (NSPS), State Implementation Plan (SIP), or National Ambient Air Quality Standards (NAAQS), powerplants would adopt a cost-effective control strategy.

- House and Senate Best Available Control Technology (BACT) require compliance with emission limitations.

- Powerplants are permitted to use all of the increment of pollution allowed in the surrounding area.

- Powerplants that cannot comply with significant deterioration requirements are assumed to relocate part or all of the impacted powerplant and/or further reduce SO_2 through low sulfur coal or scrubbers.

- The impact of alternative proposals on a sample of 74 new coal-fired powerplants is assumed to be indicative of the impact on capacity additions during the period 1980-1990.

- Electricity sales will grow at a reduced rate from historic levels: 6.1 percent from 1975-1980; 5.3 percent from 1981-1990.

- Capital costs will increase more rapidly than operating and maintenance costs over the next 15 years.

- Annual rate of inflation as measured by the GNP deflator: 1976-1980 - 5.3 percent; 1981-1985 - 4.7 percent; and 1986-1990 - 5.0 percent.

Methodology:

- Alternative pollution control techniques are considered (coal-fired-no control, low-sulfur coal, scrubbers).
- Three scenarios were developed for comparison: Base Case, Nuclear Moratorium, and Energy Conservation.
- A meteorological dispersion model was used to categorize 74 proposed powerplants.
- Resiting of powerplants was based on an analysis of water supply, transmission lines, site development cost, economies of scale and fuel penalties.

Conclusions:

- The Senate proposals will increase the electric utility industry capital requirements over the next 15 years (1975-1990) by about $11.5 billion. This is an increase of approximately 2.6 percent in the industry's projected capital requirements.
- The House proposal will increase the capital requirements by $11.2 and $11.6 billion, that is, 2.5 percent to 2.7 percent of projected requirements.
- Both proposals will increase the average residential bill (direct and indirect) by $28 per year in 1990, an increase of 2.3 percent.
- Both House and Senate proposals require an additional 95,000 megawatts of scrubber capacity over present EPA requirements.
- The energy requirements of the scrubbers necessitate construction of another 3,300 megawatts of coal-fired capacity by 1990.
- Both proposals will reduce the demand for western coal in 1990 by about 35 million tons (5 percent less than projected).
- Midwest plants may use scrubbers and high sulfur coal due to the reduction in western coal production.

- The capital and energy requirements of both proposals would be considerably reduced if EPA's current definition of BACT were substituted for the House and Senate definitions.

  - Senate: $11.5 billion capital requirement reduced to $2.1 billion; House: $11.2 billion to $11.6 billion capital requirement reduced to $1.2 billion to $1.7 billion.

  - Senate: 95,000 megawatts scrubber capacity reduced to 5,000 megawatts; House: 95,000 megawatts scrubber capacity reduced to 10,000 megawatts.

- Emissions by 1990 would be reduced 17 percent under EPA version of BACT and 35 percent under House and Senate version of BACT.

- The impact of Class I requirements on industrial facilities in Class II areas is extremely sensitive to the number of Class I areas and the definition of BACT areas.

U. S. Environmental Protection Agency. "Summary of EPA Analysis of the Impact of the Senate Significant Deterioration Proposal." No date (circa April 1976).

Purpose:

To summarize analyses that EPA and its consultants have conducted on the impacts of the Senate nondeterioration proposal (S.3219) on selected major industries, including electric utilities, Kraft pulp and paper, refineries, synthetic fuel plants and copper smelters.

Assumptions:

- Extractive industries, such as strip mining, are not covered by the requirements of the Senate bill.
- Major industrial sources are not covered by the Senate requirements unless they are specified in the amendment.
- The assumptions underlying the analysis are not discussed.

Methodology:

- Modeling analyses to estimate the size and type of facilities that could be constructed at one site under the Senate proposal. Nature and structure of the models are neither discussed nor presented.
- Location impacts are based on EPA's best estimate--the estimate with minimal adverse location impact.
- Location impacts are appraised in terms of:
  - Maximum size of plant that can be constructed.
  - Minimum separation distance between major industrial facilities.
  - Closest distance a typical major industrial facility can locate to a Class I area.
- Economic impact assessment is based on changes in:
  - Aggregate national capital needs of the electric utility industry over the next 15 years.
  - The average expenditure by U. S. households for electricity in 1990.

Conclusions:

- The Senate significant deterioration proposal will not prevent the construction of major, economically sized facilities. Rather, some sources may have to employ different air pollution control strategies, such as:

  - Further control of sulfur dioxide emissions.

  - Relocation at an alternative site.

  - Construction of taller stacks.

  - Construction of smaller plants.

- The proposal allows for collocation of major industrial sources. In Class II areas, the minimum required separation distance for economically sized facilities meeting New Source Performance Standards (NSPS) is:

  - 0 to 40 miles for electric powerplants.

  - 0 to 12 miles for Kraft pulp and paper mills.

  - 0 to 3 miles for oil shale plants.

  - 0 to 30 miles for gasification plants.

  - 0 to 18 miles for refineries.

  - 5 to 16 miles for copper smelters.

- If control beyond NSPS is assumed, the minimum required separation distance for plants in Class II areas is reduced from 25 to 80 percent.

- If a source must comply with Class I increments, it would be required to locate some minimum distance from the Class I area. The following minimum and maximum distances correspond with the best estimate of control up to NSPS and control beyond NSPS for a typical sized plant. Separation distances are:

	Minimum Separation	Maximum Separation
- Power Plants	5 miles	60 miles
- Oil shale Plants	3	8
- Gasification plants	7	40
- Refineries	12	43
- Copper smelters	13	21

- Electric utility industry will experience the major economic impact. Capital requirements over the next 15 years will increase by up to $11.5 billion. This is roughly a 3 percent increase in industry capital requirements. The average residential customer will pay a maximum of $28 more per year for electricity in 1990.

- Other industries will probably have to employ different air pollution control strategies, such as:

  - Further control of sulfur dioxide emissions.

  - Relocation at an alternative site.

  - Construction of taller stacks.

  - Construction of smaller plants.

- Class III designation or a variance from the Class II increments is probably required in some urbanized areas in the post 1980 period. Otherwise, significant restrictions and/or altered development patterns would occur by 1990. A similar designation or variance would probably be required for energy and industrial parks and for copper smelters and gasification plants in very hilly terrain.

Vierath, D. R. and Walkey, Warren W. "An Evaluation of Additional Production Costs from Significant Deterioration and Best Available Control Technology Proposals." April 26, 1976. A report prepared for The General Electric Company.

Purpose:

Assess the additional capital and operating costs that would be incurred by the electric utility industry as a result of significant deterioration and Best Available Control Technology (BACT) proposals being considered by the House and Senate.

Assumptions:

- Planned generating capacity additions are adequate to meet projected load growth of 7.5 percent per year through 1980. Projections in this study cover 1981-1990 and are based on the 7.5 percent rate of growth.

- System productions costs equal 50 percent of total cost of electric energy.

Methodology:

- Costs employed in the study were average costs for the United States electric utility industry, adjusted for regional cost differences.

- A fixed charge rate of 18 percent was used to calculate capital costs. Operating and maintenance costs were based on actual operating experience. Year-by-year production costs were calculated in 1974 dollars.

- Four alternative calculations were made on the General Electric Optimized Generation Planning Program, and KWH costs over the 1981-1990 period were calculated.

- The four alternative calculations were based on:

  - No control.

  - New Source Performance Standards (NSPS) controls.

  - BACT/High Nuclear, assuming Flue Gas Desulfurization (FGD) and installation of 240 nuclear units over the period.

  - BACT/Low Nuclear, assuming FGD and installation of 120 nuclear units over the period

Conclusions:

- Based on the projected growth rate of 7.5 percent in generating capacity, capital requirements for production equipment in the utility industry would range from $107 to $127 billion over the 1981-1990 period. Total production costs would range from $170 to $250 billion.

- Based on these projected capital and production costs, the average cost of electric energy in 1990 would range from 7.8¢ to 10.0¢ per KWH. For each of the alternatives, the average cost would be:

  - No controls: 7.8¢ per KWH.

  - NSPS: 8.0¢ per KWH.

  - BACT/High Nuclear: 9.5¢ per KWH.

  - BACT/Low Nuclear: 10.0¢ per KWH.

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APPENDIX D

OPPORTUNITIES FOR "PRIVATIZATION": IMPROVING MUNICIPAL AND SOCIAL SERVICES*

"Privatization" of local service functions has appealed to some observers as a way to ease the tremendous burdens imposed on local government by straitened financial circumstances and expanding service demands. However, answers to the questions whether, where, and how to utilize the private sector are elusive. On one hand, the limitations of conventional service mechanisms seem painfully apparent. As public service monopolies, measuring success in votes instead of profits, local governments appear frequently to lack the incentive to improve productivity. Their flexibility and initiative seem further impaired by rigid procedural formulae, bureaucratic aversion to risk, and the resistance of established interests.

"Privatization," and especially the public purchase of all or part of a service from private suppliers, may be a way to overcome these disabilities. But "privatization" efforts also confront major problems. One of these is the lack of comparative data on the merits of private versus public service delivery and the methodological difficulty of making valid comparisons. In general, it is simply not clear which services should be "privatized," or how. A second problem is that, even where particular case studies (or the intuitions of local officials) have projected probable cost savings as a result of "privatization," local governments almost uniformly lack the technical expertise to contract effectively. This is at least partly the result of gaps in the technology itself, especially in the area of performance measurement. Finally, even where the data are sufficient and technological obstacles can be overcome, efforts to expand the range of local service options--to obtain the most productive combination of public and private service delivery capabilities--may be hindered by restrictive statutes and regulations and by the political opposition of affected interest groups.

In the following pages these problems and their implications for public policy are considered at length. The discussion is divided into five unequal parts. The first, which deals principally with the epistemological issues, includes: a review and assessment of existing research; a summary of organizational options for local service delivery; a summary and evaluation of the principal arguments for and against "privatization"; an explanation of the difficulty of making valid public-private

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*This paper was prepared by Jeffrey L. Mayer of the Office of the Assistant Secretary of Commerce for Policy, drawing on sources as noted.

delivery cost comparisons; and a consideration of *a priori* indices of suitable candidates for "privatization."

The second and longest part is devoted to a service-by-service summary and evaluation of the best available evidence bearing on the frequency and cost advantage (or disadvantage) of "privatization," and on the opportunities for further private involvement. The structure and content of this part of the paper owe much to an unpublished Urban Institute study prepared in 1974, for the National Commission on Productivity. The services considered are: solid waste collection; public works; police; fire; ambulance; transportation; parks and recreation; and miscellaneous technical services; as well as social services provided under Title XX of the Social Security Act.

A third segment of the paper is concerned with the technological obstacles to good purchase-of-service contracting. A fourth reviews some of the related political difficulties. And a fifth contains a discussion of directions for further work and initiative.

Two additional introductory comments seem appropriate: one to supply a preliminary definition of the term "privatization"; and the second to suggest the legitimate purposes of the practice itself.

Strictly speaking, "privatization" ought to connote a complete divestiture of public responsibility for the satisfaction of citizens' service needs; with private individuals left to provide services for themselves either personally or by purchase agreements with non-public producers. In common usage and in this paper, however, the term is applied more loosely to the entire range of public service arrangements except direct public provision; that is, to each of the many forms of participation by private proprietary or non-profit providers in the delivery of local services. In almost all of these, it should be noted, "privatization" allows no abdication of public responsibility, but demands close and continuous governmental supervision.

Finally, despite the current fashion in political rhetoric to deplore the growth of the public sector, "privatization" should not be pursued as an end in itself, but as a means to improve the quality and limit the cost of local services. Importantly too, "privatization" should not be understood as an alternative to a continuing effort both to improve public management and to increase the resources available to municipal governments through economic development, tax reform, jurisdictional adjustment, and federal and state aid.

Searching for a More Productive Public-Private Partnership--Epistemological Considerations

A Survey and Assessment of Recent Research

An unpublished Urban Institute report on Purchase of Service Contracting by Local Governments (1974) suggests that while there have been several well publicized studies of opportunities for "privatization" of particular service functions in specific localities, "there has not been, so far as we know, any attempt to review the situation nationally across a wide range of local government services."[1] To date, the best such effort is still the Urban Institute report itself, though there are some other valuable sources of comprehensive data. Thus, for example, the Municipal Yearbook 1973 documents the results of an extensive survey of the incidence of purchase-of-service contracting by municipalities for a large number of local government functions.[2] And a 1970 special report by the American Public Works Association indicates regular use of private contractors for several important public works functions.[3]

The absence of comprehensive research on "privatization," however, is only partly a result of the subject's relative novelty and intimidating complexity. A more telling reason may be that, apart from cataloging interesting cases, or revealing general trends, or suggesting functional areas of possible comparative cost advantage for private (or public) service producers, comprehensive research cannot supply general formulae for instructing specific localities about what, when, and how to "privatize." Local decisions must still be determined by cost and quality comparisons, as well as by political and administrative considerations peculiar to those decisions alone. It is hardly surprising, therefore, that the bulk of the research on "privatization" treats specific functions and localities.

Individual case studies tend to be concentrated on services for which inputs and outputs are easily quantified or where public and private providers presently work side by side--for example, in waste collection or public works. As in the case of the City Administrator's seminal and controversial comparison of public and private refuse carting costs in New York City (1970), however, the scientific value of many of these studies has been seriously challenged. What seems clear, nonetheless, is that the existing case research reveals no sharp and unvarying pattern of cost advantage for public or private providers. While "horror stories" abound on both sides of the question, the most productive system of service delivery for any particular circumstance and service must be determined, and periodically redetermined, locality-by-locality and service-by-service.

Organizational Options

Current practice in municipal and social service delivery suggests a range of institutional choices in regard to providers, methods payment, and modes of operation. Thus, in the case of providers, alternatives include not simply governments and private business, but a variety of independent or quasi-public agencies as well as private non-profit contractors. Payment may be rendered indirectly through taxation, or by a system of user charges, or by a combination of the two. In regard to the organization of particular service functions, the choice again is not simply one of assigning sole responsibility to public or to private providers. In practice, purchase agreements rarely transfer operational responsibility for all of a particular service. For a number of sound reasons, governments commonly prefer to contract with other suppliers for part of a local service, while continuing to provide a portion of that service themselves. Moreover, when they do contract out, the contractor is more likely to be another locality, or the state or federal government, than a private organization.[4]

While the most prominent variety of "privatization" is probably the private purchase of services by governments for citizens, the range of organizational possibility which the term connotes is very broad. At one extreme "privatization" may involve a laying aside of all public responsibility for meeting local service needs, an abandoning of citizens to negotiate directly with private producers the price, quantity, and quality of desired services. Or it may entail the setting of limits on government's responsibility in particular areas, leaving individuals to turn to the private market for additional or improved services.

Even where governments seek relief from direct responsibility for meeting local service needs, however, they may still exercise substantial control over private suppliers by diverse indirect means. They may, for example, determine the quality and/or the scope of privately provided services by franchising or licensing only those producers who meet certain standards; or they may influence service industry operations by regulating profits, fees, and salaries, or by offering a variety of economic incentives. Conversely, they may require households, individuals, or businesses to consume certain services, while leaving the private sector a free hand in the organization of supply.

While "privatization" commonly connotes a range of organizational formulae, the term also seems to suggest the active reordering by governments of conventional service delivery arrangements. Importantly, in the latter sense, "privatization"

rarely happens in the real world. Current experience indicates that local governments are generally reluctant to alter existing service delivery systems, whether these are public or private. Extensive research by the Urban Institute uncovered "approximately 30" cases of switching (most involving sanitation and data processing services), about equally divided between switches from public to private providers and switches from private to public providers. The chief policy implication of this relatively static organizational pattern seems to be that, with certain exceptions, in those cases where switching promises clear and substantial productivity gains, the greatest opportunity for "privatization" may lie beyond the range of traditional municipal services--in those areas, for example, where the level of demand for conventional service needs exceeds the response capacity of local governments, or where there is a market for more flexible and variegated local services, or where technological developments or state and federal legislation have created new service requirements.

Arguments For and Against "Privatization"

Prospective Economies. Economic questions provide a focus for much of the current debate on "privatization." Proponents claim that service costs can be reduced without sacrificing quality, or that quality can be upgraded without raising costs, by increasing competition in appropriate service areas and by encouraging local jurisdictions to contract (with private organizations and other units of government) for skills and equipment that are highly specialized, or costly, or infrequently utilized.

On the other side, critics contend that "privatization" tends to increase consumer costs because private producers must factor profit margins and tax expenditures into service prices. Furthermore, they claim, "privatization" jeopardizes quality because private contractors may cut corners to increase profits. Also, private firms may default on contract obligations; or they may lower prices artifically to win contracts, and then raise them exorbitantly when potential competitors (including government itself) have left the field; or they may conspire in bidding for contracts to keep prices high.

Advocates of "privatization" respond that these dangers can be largely averted through precise drafting of requests for proposals, careful selection of providers and ample performance bonding, skillful contracting and contract management, the use of multiple contractors, and the thorough evaluation of service outcomes. Undeniably, however, the exercise of these precautionary measures, and the cultivation by local governments of the expertise such exercise demands, add appreciably to the full cost of

"privatization." Moreover, this cost may be further compounded by the social cost of displacing public employees, or indeed by the costs generated by employees' resistance to layoffs, or by the short-term underutilization of city-owned plants and equipment.

Flexibility. After the issue of comparative cost-effectiveness the next most contested question in the current debate seems to be whether "privatization" enhances or detracts from local government's capacity to act flexibly in the face of shifting needs and opportunities. On one hand, it has been pointed out that purchase-of-service contracting enables local jurisdictions to launch new programs while avoiding large start-up costs for equipment, facilities, and personnel training. More importantly perhaps, given the uncertain fiscal circumstances of many localities, "privatization" seems to allow rapid increase or decrease in the size of operating programs. On the other hand, critics contend that "privatization" really constrains local governments by limiting their immediate control over the quality, cost and continuity of services, as well as by impairing their ability to implement minority hiring and other social policies. As in the case of cost considerations, however, potential obstacles which "privatization" poses to the flexibility of local authorities seem to be largely avoidable by good contracting procedures.

Indeed, the importance of effective contracting for the productive "privatization" of local service functions can hardly be overstated. Perhaps the most telling argument against "privatization"--in the short-term at least--may be that the ability to draw contracts skillfully and monitor them energetically does not now exist in many localities.

Other Arguments. A number of additional arguments on the merits of "privatization" have been advanced by analysts and by public officials themselves. On the plus side, it has been pointed out that by contracting for part of a service, cities acquire a yardstick to evaluate the performance of those portions of the service which they retain; though, of course, comparisons are possible even without such "double-tracking." A further possible advantage of "privatization"--one which probably looms larger in the perceptions of harrassed officials than those of dissatisfied citizens--is that it provides public authorities with a respite from day-to-day worries about citizens' complaints, equipment breakdowns, and labor turn-over. It has also been suggested that by dividing functional and supervisory responsibilities purchase-of-service contracting contributes to better overall management. Local governments are forced to evaluate their needs and current capabilities with increased rigor, and to specify performance expectations and methods of evaluation. Lines of accountability are explicit. And contractors are free to focus all their attention on day-to-day operations.

Problems of Comparative Cost Computation

Available data on the cost of direct versus private provision of local services are both "surprisingly skimpy" and consistently ambiguous. The latter circumstance, in particular, results in part from local variations in the relative capabilities of public and private service producers, and in part from the inadequacy of existing cost accounting procedures.

Local Variations. Variations in local operating methods and in the relative capabilities of public and private providers tend to prevent generalizable conclusions about the benefits and liabilities of service contracting. The search for universal formulae, through the comprehensive examination of service experiences in a broad sampling of localities, has limited significance for the choice of specific service delivery arrangements. On the other hand, case research can be misued to support polemical assertions either pro or contra "privatization." Nonetheless, because of the variety of local conditions and capabilities, the most valuable research is likely to be that which confines itself over an extended period to one or a number of service functions in individual municipal contexts.

Methodological Imprecision. Some of the argument about the merits of "privatization" has been fueled by disagreements on methodology.[5] In fact, assessment of the full cost of either public or private provision of services is a far more demanding task than it at first appears to be. The difficulty results in part from incomplete cost accounting by most localities. Cost estimates for direct provision are likely to ignore capital budget expenditures, the value of fungible space in municipally owned buildings, service provided without charge by other city agencies, and perhaps even fringe benefits for public employees. At the same time, municipalities may underestimate the cost of private contracting, especially by overlooking the continuing burden of contract management. In addition, one observer has remarked, competitive bids by prospective private providers may be artificial indices of likely first-year costs, owing to the pressure of competition (from other bidders and from government itself). Once government has dismantled its own service machinery, or as the number of alternative private providers dwindles, the cost of privately supplied services may increase substantially.

Despite the methodological obstacles to effective cost comparison, and the sparsity and ambiguity of existing data, however, the weight of preliminary opinion cautiously but clearly favors continued experimentation with service contracting. Thus, for example, a former New York City Budget Director has remarked

that the immense variety of local circumstances suggests that there are "patently thousands of cases" where "privatization" may be a practicable spur to increased productivity.[6] In a similar vein, researchers at the Urban Institute observe that "there are enough potential advantages [to be gained through service contracting] that in selected instances a wider use of arrangements for purchasing services from private firms should at least be considered by local governments."[7]

Candidates for Privatization--A Survey of a priori Indications

The question whether and when a public service function should be contracted out must finally be decided, for each city and each function, on the basis of careful cost and quality comparisons, as well as considerations of local realpolitick. However, reflection on past practice, together with "the theory of public goods," may suggest some general a priori conclusions about how service responsibilities should be allocated.

Practical Considerations. Apart from basic police functions, which local governments could not surrender without subverting confidence in public authority or sacrificing a traditional and fundamental portion of their own identities, there are in theory no municipal or social services which could not be privately supplied. However, the practical requirements of effective contracting, along with contingent political obstacles and market imperfections, narrow the range of likely candidates considerably. In the former regard, services which are practically suited to private purchasing arrangements are those for which resource inputs and/or performance outputs are easiest to define, and, therefore, for which contracts can be precisely drawn and closely monitored. The premier example of such a service is, of course, waste collection; but other good examples include public works functions--building, bridge, and street construction, street lighting, water and electricity supply, as well as building, street, and traffic control system maintenance.

Additional constraints on purchase-of-service contracting are imposed by the reluctance of established bureaucracies to experiment with new service arrangements, particularly those which threaten the size and importance of the public labor force, and by restrictive legal and regulatory structures. Contracting opportunities are also limited by the inability, or traditional hesitancy, of the market system to respond to certain kinds of public demands. Where there are no private providers, or none of sufficient size to operate effectively and economically--as is almost universally true in the case of fire protection--contracting is patently impossible. Even where private firms have the capacity to replace public providers, however, simple substitution may be meaningless if it does not increase competition.

If potential private suppliers are too few, so that public monopolies are merely supplanted by private ones, or if they conspire among themselves (or with corrupt officials) to control service prices, the benefits of "privatization" may still be inaccessible, and direct public provision may remain the wisest course.

On the positive side, as has been suggested, the reluctance or inability of local governments to expand quickly in response to shifting public demands or the sudden availability of new resources may create broader opportunities for private contracting in new or rapidly expanding service areas than presently exist in the historic domains of mature public service bureaucracies.[8] Developments in management technology, likewise, may offer the chance for private sector activity outside the normal range and beyond the conventional expertise of local government agencies. Generally speaking, of course, all services which require specialized skills and equipment, or which are needed only intermittantly, are good candidates for "privatization"--especially, in smaller jurisdictions which stand to realize economies of scale.

The Theory of Public and Private Goods. While it provides little guidance in the division of labor among public and private providers, the theory of public and private goods does suggest a demarcation between the range of services which local governments may advantageously purchase for themselves or their constituents and those which may be left entirely to the private market.

Public goods are characterized by their indivisibility and, for practical purposes, by their infinitude. Thus, for example, the benefits of a public park or a pretty view cannot be rendered in discrete chunks to particular individuals. Moreover, one person's consumption of such benefits does not normally diminish the supply available to others. Conversely, private goods--such as food, seats at the opera, and family counselling--tend to exist in limited supply and to be divisible and deliverable exclusively to specific individuals or groups.

Because they can be delivered on a fee-for-service basis, private goods are likely candidates either for purchase-of-service contracting or for "privatization" in the purest sense. In most localities, transportation, health, and waste collection services, as well as entertainment, recreational, and cultural opportunities are already supplied in return for user charges by both public and private providers. Where the market evokes private initiative, and where competition or public regulation can be relied on to exercise cost and quality controls and fair labor practices, there seems to be no reason, in principal, for such private goods to be provided by public agencies either directly or through purchase-of-service contracting. Individual consumers could be

left to bargain independently with private service producers, either spontaneously or in response to local ordinances.

On the other hand, purchase-of-service contracting seems to be the most appropriate way to involve the private sector in supplying goods which cannot be delivered exclusively, or charged to individual consumers.[9]

Available Evidence on "Privatization": Incidence, Comparative Costs, Prospects

In curious contrast to the increased interest in "privatization" during the past several years, available evidence suggests that there is a surprisingly small amount of local contracting for conventional municipal services.[10] In addition, surveys conducted by the International City Management Association (ICMA) in 1963, and by ICMA and the Advisory Commission on Intergovernmental Relations (ACIR) in 1973, hint that there may even have been a slight decline in the percentage of localities purchasing those services which have traditionally been provided by private firms (for example, solid waste collection and street lighting). Nonetheless, as Table I demonstrates, for several basic services the number of cities contracting with private firms remains a very high proportion of the entire contracting population. There is also evidence to support the argument that, in non-traditional service areas (those, for example, that have recently been created by federal legislation or by new management technology) private contracting has increased.

The pages immediately following summarize, function-by-function, the available evidence on the frequency, the effects, and the prospects of purchase-of-service contracting by local governments.

Solid Waste Collection

Recent surveys suggest that not more than about 20% of American cities contract with private firms to provide some portion of their residential, commercial, or other solid waste collection. Table I indicates that only 309 (14%) of 2,248 sample cities contract for some of their waste collection, although most of these (88%) contract with private providers. The Urban Institute reporters note that 21% of the jurisdictions surveyed in 1964 by the American Public Works Association (APWA) contracted all or part of their refuse collection services, though sampling differences preclude reliable conclusions about purchasing trends. The most recent, and in the investigators' estimate "the most authoritative [study of the subject] to date," tends to support the APWA findings; an interim report on research

still underway at Columbia University's Center for Government Studies, indicates that 20.5% of a sample of 2,052 jurisdictions (with populations ranging from 2500 to 750,000) contract for all or part of their residential "mixed refuse" collection. A somewhat smaller percentage (18.1) rely entirely on contracts with private providers for this particular service.[11]

As the Columbia study shows, however, these figures supply only a partial indication of the comparative public-private sharing of the residential "mixed refuse" collection market, since private providers deal directly with citizen-consumers (and not local government) in by far the largest number of jurisdictions reporting either some or sole private collection. In fact, fully two-thirds of the Columbia sample indicate some kind of private collection of some part of their residential "mixed refuse," and 45.2% report sole dependence on private sources.[12]

Data on the comparative cost of public and private waste collection is plentiful, inconclusive, and frequently misused. As noted above, a well known and widely controverted (1970) study of sanitation costs in New York City discovered a per ton cost advantage of about 67% for private collection (which one investigator later attributed to "overmanning, overpaying, and underworking" on the public side). A review and update of the data two years later resulted in a downward revision of the original figure to about 50%, though the value of either comparison may be impugned by the dissimilarity of public and private collection functions in New York City.

In Minneapolis and St. Paul, on the other hand, where public and private firms work side by side, comparisons may be more meaningful. In St. Paul, the average 1972 yearly prices charged to residents by private and municipal collectors were $42.00 and $46.80 respectively. Similarly, in Minneapolis, comparative costs per ton in 1972 were $34.71 and $37.38. A 1968 Urban Institute study of 74 localities with public and five with private collection found that the latter jurisdictions paid 30% less per ton,and that the number of tons collected per man was about 40% greater for the private firms. In addition, a 1973 study published by the National Commission on Productivity noted that one community had saved $92,000 on a $1 million plus budget by switching to a private contractor; while another community is reported to have achieved a 25% savings by the same means.[13] Finally, a study in Winnepeg in 1972 estimated that private collection was substantially less costly than public collection (14.4¢-18.6¢ per pickup compared to 19¢-58.3¢ per pickup).[14]

In contrast to these findings, a 1963 study of 20 municipalities in the St. Louis area found no significant difference

between the costs to those cities providing their own waste collection service and those contracting with private providers.[15] In addition, in 1976, Cincinnati decided not to contract for garbage collection after a study which projected resulting increased costs to the city of 33% to 50%. And a private study commissioned by the Seattle City Council, after private contractors announced a rate hike of nearly 50%, estimated that $1.5 million could be saved in that city by a reversion to direct municipal collection. Finally, the Richmond, Virginia, City Manager has estimated that the city will save nearly $1.5 million annually when it assumes refuse collection responsibility (in 1977) in that part of the city where refuse collection has been contracted out.[16]

The current Columbia University study has produced a comprehensive estimate of comparative collection costs in a 340-city sample. The investigators conclude, tentatively at least, that in cities with populations below 50,000 there is no significant difference between the cost of contracted services and direct public provision. In cities with populations above 50,000, however, the cost per household is found to be 29% greater for municipal collection than for private collection.[17] According to the investigators, the major portion of this difference must be attributed to "factors which some people might call 'government inefficiency.'" They contend that in cities larger than 50,000 people, municipal collection agencies have higher employee absentee rates than private contractors (12.0% versus 6.5%), use larger crews (3.26 men vs. 2.15), and, as a result, spend more time servicing each household (4.35 man-hours per year vs. 2.37). Also, municipal agencies tend to use smaller trucks and more which are rear-loading (and, therefore, not easily loaded by a driver alone).[18]

The Columbia research also indicates that purchase-of-service contracting by local government is significantly less costly than private consumer-provider arrangements for waste collection service. This results apparently from the facts that public contractors have no billing costs and that their collection routes tend to be more coherent (than those of other private providers). An additional finding of the research, which may broaden the range of opportunities for private contracting, is that, when other factors are held constant, collection costs per household decrease as city size grows, certainly to 20,000, and perhaps to 50,000. Above 50,000 size does not seem to affect costs.[19] Thus, where large municipalities anticipate benefits from increased competition, they may divide themselves into refuse collection districts of 20,000 to 50,000 people, and invite private firms to bid for service contracts in each district, without sacrificing economies of scale.[20]

Public Works

Public works has been a traditional domain of private firms working under contract to local jurisdictions. In an APWA survey of American cities with public works departments, for example, 750 of 752 respondents indicated a policy of contracting for some or all local construction; 291 (39%) specified exclusive use of contract construction. Of 703 cities responding to a question on average annual ratio of contracted to overall local construction values (during the previous five years), 58% had purchased at least three times as much construction from private sources as they had obtained by other means; 74.6% had purchased more than half of their total construction.[21]

The APWA study also found a high incidence of municipal contracting for maintenance functions, though many of the (770) reporting cities continued to perform a substantial amount of maintenance work themselves. Thus, for example, less than 1% of (314) reporting cities contracted for all street maintenance, and only about 3% (10 of 351 respondents) purchased all of their equipment maintenance privately; though, at the opposite extreme, more than half (154) of 273 responding cities reported contracting for all traffic signal maintenance, and 92% (472 of 511) contracted for all radio equipment maintenance.[22]

For other public works functions, however, the 1973 ICMA-ACIR survey indicates a considerably lower level of private contracting. Only 6% of the municipalities in the ICMA-ACIR sample reported buying solid waste disposal from private firms; though a 1968 APWA study suggests that in waste disposal, as in waste collection, municipal contract arrangements account for only part of the private sector's share of the market. (In 1968, according to the APWA findings, there were 4,811 public and 4,032 private disposal sites in the United States.) Only about 1% of the ICMA-ACIR sample reported purchasing snow removal service, and about 3% reported buying their water supply from private firms; though here again the private share of the market is probably larger than the contracted share, since about 15% of the nation's water companies are privately owned. One percent or less (of the ICMA-ACIR sample) reported contracting with private suppliers for other public works services: business and mechanical inspection; electrical and plumbing inspection; sewage lines; and sewer disposal. (See Table I.)

Cost comparisons for municipally versus privately supplied public works services are extremely rare. However, a very interesting study undertaken in Winnepeg in 1972 has estimated that city costs exceeded those of private contractors for road construction, street maintenance, and sewer and water main construction.[23] Official reaction to these estimates is instructive with regard to the prospects for "privatization" of core services in other cities. Manitoba's Minister of Public Works protested that "it would be sheer nonsense" to disband city work crews, in part because "it would put hundreds of people out of work," but also because it was not clear what would become of large city investments in plants and equipment.[24]

Interesting evidence is also adduced in a report by New York City's Office of Administration which asserts that in 1971 it cost the City $57.17 per ton of asphalt to resurface its own streets (with a two-inch asphalt overlay), while similar work by private contractors in the New York metropolitan area cost only $18 to $20.[25] Others have suggested, however, that private contractors probably could not resurface New York streets at a profit for less than $27 or $28 per ton of asphalt.[26]

Despite the tradition of frequent--or, at least regular--local contracting for certain construction and maintenance services, opportunities for expanding the private sector's share of the public market may be limited. Part of the reason, as the Public Works Minister of Manitoba remarked, is the short-term economic and political cost if "privatization" results in extensive job dislocations or idle city plants and equipment. One cost, which is probably unavoidable and may be prohibitive, is the resistance of public employee unions. In fact, union contracts in a number of cities (for example, Detroit, Philadelphia, New Orleans, and Milwaukee) contain clauses against contracting for public works services.

Also, the need for large initial investments may discourage private entry into much of the public works market or keep short-run contracting costs high.

Police Services

Because police powers are essential to the identity and stability of public authority, local governments almost never delegate them to non-public agencies. Thus, while smaller cities in some parts of the country rely heavily on contracting

TABLE I

INCIDENCE AND VARIETY OF PURCHASE-OF-SERVICE CONTRACTING BY LOCAL GOVERNMENTS (a)

SERVICE	NO. OF CITIES IN SAMPLE (B) 2,248	NO. OF CITIES REPORTING (A)	NO. OF CITIES CONTRACTING WITH OTHER PUBLIC ENTITIES (b)			NO. OF CITIES CONTRACTING WITH PRIVATE FIRMS (c)		
			NO.	% OF (A)	% OF (B)	NO.	% OF (A)	% OF (B)
Assessing		207	176	85	8	31	15	1
Payroll		114	54	47	2	60	53	3
Tax Collection		191	168	88	7	23	12	1
Treasury Functions		50	36	72	2	14	28	1
Utility Billing		177	78	44	3	99	56	4
Election Administration		121	114	94	5	7	6	0
Legal Services		204	32	16	1	172	84	8
Licensing		53	49	92	2	4	8	0
Microfilm Services		66	25	38	1	41	62	2
Personnel Services		77	71	92	3	6	8	0
Public Relations		41	14	34	1	27	66	1
Records Maintenance		40	32	80	1	8	20	0
Registration of Voters		91	89	98	4	2	2	0
All Public Health Services		279	275	99	12	4	1	0
Air Pollution Abatement		180	179	100	8	1	0	0
Alcoholic Rehabilitation		118	110	93	5	8	7	0
Ambulance Service		280	129	46	6	151	54	7
Animal Control		300	208	69	9	92	31	4
Cemeteries		90	46	51	2	44	49	2
Hospitals		136	82	60	4	54	40	2
Mental Health		120	99	83	4	21	17	1
Mosquito Control		132	120	91	5	12	9	1
Noise Abatement		68	66	97	3	2	3	0
Nursing Services		114	81	71	4	33	29	1
Water Pollution Abatement		119	115	97	5	4	3	0
Welfare		102	101	100	4	1	0	0

TABLE I (Cont'd.)

SERVICE	NO. OF CITIES IN SAMPLE (B) 2,248	NO. OF CITIES REPORTING (A)	NO. OF CITIES CONTRACTING WITH OTHER PUBLIC ENTITIES(b)			NO. OF CITIES CONTRACTING WITH PRIVATE FIRMS(c)		
			NO.	% OF (A)	% OF (B)	NO.	% OF (A)	% OF (B)
Flood Control		128	128	100	6	0	0	0
General Development		54	44	81	2	10	19	0
Housing		118	111	94	5	7	6	0
Industrial Development		88	64	73	3	24	27	1
Irrigation		30	25	83	1	5	17	0
Mapping		128	61	48	3	67	52	3
Planning		282	198	70	9	84	30	4
Soil Conservation		102	98	96	4	4	4	0
Urban Renewal		73	67	92	3	6	8	0
Zoning and Subdivision Control		99	83	84	4	16	16	1
Parks		140	136	97	6	4	3	0
Recreational Facilities		174	168	97	7	6	3	0
All Police Services		142	142	100	6	0	0	0
Crime Laboratory		300	295	98	13	5	2	0
Criminal Identification		219	219	100	10	0	0	0
Patrol Services		86	84	98	4	2	2	0
Police Communications		299	294	98	13	5	2	0
Police Training		392	390	99	17	2	1	0
School Crossing Guards		89	89	100	4	0	0	0
Traffic Control		110	106	96	5	4	4	0
Jails and Detention Homes		446	445	100	20	1	0	0
Juvenile Delinquency Program		114	111	97	5	3	3	0
Probation and Parole		100	100	100		0	0	0
Work Release		40	40	100	4	0	0	0

TABLE I (Cont'd.)

SERVICE	NO. OF CITIES IN SAMPLE (B) 2,248	NO. OF CITIES REPORTING (A)	NO. OF CITIES CONTRACTING WITH OTHER PUBLIC ENTITIES(b)			NO. OF CITIES CONTRACTING WITH PRIVATE FIRMS(c)		
			NO.	% OF (A)	% OF (B)	NO.	% OF (A)	% OF (B)
All Fire Services	248	239	96	11	9	4	0	
Fire Communications	162	158	98	7	4	2	0	
Fire Prevention	84	82	98	4	2	2	0	
Training of Firemen	185	183	99	8	2	1	0	
All Civil Defense	233	233	100	10	0	0	0	
Civil Defense Communications	97	95	98	4	2	2	0	
Civil Defense Training	90	90	100	4	0	0	0	
Bridge Construction & Maintenance	138	114	83	5	24	17	1	
Building & Mechanical Inspection	75	68	91	3	7	9	0	
Electrical & Plumbing Inspection	122	106	87	5	16	13	1	
Electricity Supply	285	51	18	2	234	82	10	
Engineering Services	269	35	13	2	234	87	10	
Refuse Collection	350	41	12	2	309	88	14	
Sewage Disposal	307	289	94	13	18	6	1	
Sewer Lines	118	105	89	5	13	11	1	
Snow Removal	66	47	71	2	19	29	1	
Solid Waste Disposal	301	173	57	8	128	43	6	
Street Construction & Maintenance	163	107	66	5	56	34	2	
Street Lighting	359	79	22	4	280	78	12	
Water Supply	297	220	74	10	77	26	3	
Water Distribution System	163	101	62	4	62	38	3	
Special Transportation Service	90	45	50	2	45	50	2	
Management Service for Publicly Owned Transit	55	37	67	2	18	33	1	

TABLE I (Cont'd.)

SERVICE	NO. OF CITIES IN SAMPLE (B) 2,248	NO. OF CITIES REPORTING (A)	NO. OF CITIES CONTRACTING WITH OTHER PUBLIC ENTITIES(b)			NO. OF CITIES CONTRACTING WITH PRIVATE FIRMS(c)		
			NO.	% OF (A)	% OF (B)	NO.	% OF (A)	% OF (B)
Libraries		318	304	96	14	14	4	1
Museums		57	45	79	2	12	21	1
Schools		256	256	100	11	0	0	0

(a) Data arrayed in this chart were collected in an ICMA survey and presented in a somewhat modified format in The Municipal Yearbook 1973, pp. 84-85.

(b) These entities include general purpose local governments, school districts, other special districts, councils of governments or other regional units, state governments, and the federal government.

(c) The ICMA study makes no distinction between proprietary and non-profit service producers. However, social services, which have provided the broadest opportunity for local contracting with non-profit organizations, are virtually excluded from consideration. Contracts for the services which are of interest to the ICMA researchers are very likely to be with proprietary suppliers.

with larger jurisdictions to obtain basic police services, none of the ICMA-ACIR survey sample reported purchasing "all police services" from private providers. On occasion, however, local governments do contract privately for support services. Five of the ICMA-ACIR respondents (about .2% of the entire sample) used private laboratory services; two (about .1%) purchased patrol services; five hired private firms to maintain communications equipment; and two contracted privately for police training.

While local jurisdictions almost invariably supply their own police services, or obtain them from larger communities, there is a thriving private market for a range of security services that public police departments--both because of resource limitations and legal constraints--do not normally provide. Among these, for example, are doorkeeping and fire-watch duties, the enforcement of private employers' regulations, as well as the prevention, detection, and reporting of crimes on private property. A study by the Rand Corporation indicates that in 1969, 36% (or about 290,000) of the 800,000 security personnel in America were employed by the private sector as guards, watchmen, and investigators. Two thirds or more of these were in-house security forces, providing services exclusively to the businesses or individuals that employed them; the rest were contract forces, supplying services for a fee. Of the nation's total estimated $8.7 billion expenditure for public and private security that year, about $2.5 billion was spent in, and largely by, the private sector for security--about $1.6 billion for in-house, and about $620 million for contract services.[27]

Cost comparisons of public and private police functions are virtually impossible, since these functions do not normally overlap. Serious questions have been raised, however, about the quality of private protection services considered by themselves. The Rand study suggests that, while private contractors are capable of providing high-quality personnel on demand, general deficiencies in service quality may require more extensive public regulation (to establish mandatory job-specific training, bonding and insurance requirements, and standards for hiring).

For reasons noted above there is little likelihood of increased "privatization" of basic police functions, though there may be some potential for increased purchasing of support services (for example, laboratory services and equipment maintenance), or services, such as meter-minding, which require no substantial delegation of police powers. On the other hand, the private market for private security forces is expanding. Between 1960 and 1969, private expenditures for security increased 150% (as against a 90% increase on the public side), and while the number of in-house security personnel may have declined somewhat, employment among contract firms almost doubled.[28]

Fire Services

Local contracting for fire services seems to be a rarer occurrence even than "privatization" of basic police functions. Only nine (.4%) of the municipalities sampled in the ICMA-ACIR survey reported contracting with private firms for "all fire services," and only eight had purchased support services--communications equipment maintenance, fire prevention, training--privately. On the production end, the Urban Institute has identified only four proprietary firms in the fire protection business, and three of these are very small. The fourth, Rural Metro Fire Company, provides a full range of fire services to Scottsdale and a number of other Arizona cities, as well as to individual customers in non-incorporated areas.

In 1973, Rural Metro was growing at a rate of 40% a year and boasted annual gross revenues in excess of $1.5 million. (Its profits were limited by state regulation to 7% of gross receipts.) The company claims that its costs are about $4.50 per capita, one fourth the national average and, by one informed estimate, about half of what it might cost Scottsdale to supply its own fire service needs. This saving appears to result from large scale operation, the use of part-time personnel, in-house manufacturing of some equipment, and service innovations; though critics argue that Rural Metro's real advantage lies in providing fewer services than municipal departments, using older, renovated equipment, and not fully adhering to many established performance standards.[29]

Though the Rural Metro example is intriguing, there is hardly any prospect of increased proprietary provision of fire services; partly because of the likelihood of strong community and union opposition, but more immediately because of the absence of private suppliers. The possibility that new technology and more sophisticated equipment may provide some opening for private involvement in a support capacity appears to be the sole exception to this general prognosis.

It should be noted in conclusion of this section that while proprietary firms comprise a miniscule and confined segment of the nation's fire service capacity, private, non-profit fire companies (manned usually by volunteers and operating generally in less populated areas) do provide a great deal of local fire protection.[30] Thus, the non-public share of the fire protection market is substantial. It is just not especially lucrative.

Ambulance Services

A report prepared for the U.S. Department of Transportation (DOT), in 1968, observes that emergency ambulance services "are not naturally profit-making"; that is, they depend to a considerable extent on community support and supervision. Despite this judgment, however, private firms have been, and continue to be, active suppliers of both ambulance transportation and emergency ambulance services. Of the respondents to the DOT inquiry, 31% of the municipalities and 29% of the counties reported provision by private firms of at least some local ambulance service, though not always under government contract.[31]

As in the case of other local services, however, local governments and proprietary firms are not the only producers in the market. Funeral homes, volunteer organizations, and hospitals (in order of decreasing frequency) also supply ambulance services, though federal and state regulations requiring better and more comprehensive services have driven some of the financially marginal providers out of business. Interestingly, some of the latter have been local jurisdictions themselves, which lacked the facilities, financing, and qualified personnel to meet regulated standards and chose instead to up-grade through contracting with private firms.

Studies comparing the costs of municipal and commercial provision of ambulance services are inconclusive. The desire to avoid large start-up costs, rather than the prospect of long-term savings, seems to be a primary determinent of local officials' decisions to contract out.

Although, in some jurisdictions, the federally mandated up-grading of local ambulance services has prompted the transfer of operational responsibilities from public to private providers, and brought a number of independent companies into the market, a more general effect has probably been to limit commercial opportunities to those areas with population densities sufficient to support increased equipment and personnel costs. Federal matching grants for emergency medical services also tend to narrow the range of private sector opportunity, since localities only qualify for federal aid if they provide these services directly.

Transportation Services

The growth of automobile travel, development of the nation's highway system, and the centripetal press of people and jobs outward from the center cities have combined with stodgy management and inflated pay scales to undermine the profitability of local mass transit systems and to promote their transfer from private to public ownership. In recent years, this trend has been expedited by the provision of federal subsidies to cities willing to buy and run local transit facilities. The Urban Institute has reported that, between 1970 and 1974 alone, more than fifty urban transit systems were taken over by public authorities. By 1974, in fact, publicly owned systems accounted for 91% of the industry's total revenues, 90% of its work force, and 78% of all vehicle-miles travelled.[32]

A renaissance of private sector activity in the provision of local transit services is discernable at three points: the supply of management skills; the application of advanced technology; and the development and operation of new service options. By one estimate, 50% of the nation's

(1023) public transit systems were privately managed in 1974 (though the ICMA-ACIR survey discovered only 18 contracting cities).[33] At least four large firms contract with cities across the country to provide management services for publicly owned transit operations. And new companies are entering the market, some organized by former transit system owners themselves. In addition, the private sector seems to have discovered incipient market opportunities in the design and maintenance of computerized traffic control systems, as well as in the development and operation of flexible "paratransit" systems, utilizing car and van pools to transport workers to and from "multi-employer centers."[34]

Parks and Recreation Services

While the private economy is especially active in the provision of recreation opportunities for American citizens, there is remarkably little purchase-of-service contracting for parks and recreation services by public authorities. Occasionally, of course, localities do contract for construction, landscaping, or maintenance of leisure facilities, but fewer than 1% of the sample cities in the ICMA-ACIR survey reported contracting for any portion of their recreation or parks service.

Education

Private firms play a major part in American education. They supply textbooks and other curricular materials; they design, construct, furnish, and maintain school buildings; they build busses; they deliver hot lunches. In addition, there are at present in the United States some 10,000 proprietary vocational and technical training schools operating in competition with one another and with an increasing number of public, post-secondary institutions.[35] While they have been relegated to second-class citizenship in the education community, and despite the fact that their customers pay 20 times more for courses than students at comparable public institutions, they minister to a large and an apparently stable share of the vocational education market. This continued competitiveness stems partly from the fact that their curricula are more narrowly focused, shorter, and more sensitive to developments in the employment market than those of their public counterparts. It may owe something as well to the fact that much of their clientele has

already rejected (and/or been rejected by) the conventional education system. Performance, however, does not appear to be a factor. On balance, proprietary schools are as effective (or ineffective) as public schools in preparing graduates to compete successfully for the jobs they want. For the purposes of public policy, though not of individual consumer choice, the latter fact is especially interesting in view of the finding that, on the average, proprietary instructional costs are 35% below public costs.[36]

While proprietary education is an old and established area of private sector opportunity in America, recent experiments with performance contracting and vouchering may portend the development of new uses for the private economy--though the outlook in both cases is somewhat clouded. Initial efforts by private firms operating under contract to the Office of Economic Opportunity (OEO) to accelerate learning among educationally disadvantaged children through the innovative use of instructional resources and material incentives failed to produce hoped for results. OEO's own evaluation of these experiments was decidedly negative, and a subsequent Brookings Institution study concluded not only that it is extremely difficult to implement a system of performance contracting in this area, but "that the educational gains are not large and possibly not even positive.[37]

On the other hand, because the OEO-sponsored demonstrations were hastily contrived, limited in duration, and directed mainly at disadvantaged populations, and because contractors achieved differing levels of performance, it has been suggested that negative judgments about education performance contracting per se are premature. A summary review by the Urban Institute of contract experiments undertaken independently in a number of localities, after OEO's participation ceased, concludes that performance contracting retains adherents in the public education community, that encouraging results have been attained, and that at least some of the problems revealed by the earliest demonstrations--for example, teaching to evaluation tests, and uneven distribution of educational benefits--can be resolved through careful contracting and the use of external auditors.[38]

The effects of vouchering on the private sector's educational role remain largely speculative. The one major effort to test the vouchering idea at the primary and secondary levels has limited experimental value because of its confinement to public schools (of comparable quality and with similar curricula) and its guarantee of staff employment and school survival rights.[39] Looking to the future, it may be that the political pressures which narrowly limited the scope and effects of this first experiment will continue to present a major obstacle to any broader testing of the idea at the primary and secondary levels. For this reason, the best immediate opportunities for vouchering arrangements may be at the post-secondary level, not merely, as some have suggested, to preserve the diversity and integrity of private colleges and universities, but also to facilitate access to career training at proprietary schools and, in the form of youth employment scholarships, to subsidize wage payments to on-the-job trainees.

Specialized Services

In addition to services which are provided directly to citizens by local governments, or by private firms operating under government contracts, localities commonly purchase a range of specialized services which benefit citizens indirectly by helping public officials to do a better job. Some of these--especially mass transit management--have been considered above. Others are reviewed here.

Engineering services seem to be among those contracted for most frequently. Of the 2614 municipalities with public works departments polled by the APWA in 1970, 754 respondents (28.8% of the entire sample) reported a policy of contracting for engineering services. A high percentage of the smaller respondents (10-15,000 people) used engineering consultants on all projects; while among the mid-sized cities (50-250,000 people) consultants were often used on complex tasks. The largest cities tended to hire private engineering expertise only when workloads exceeded in-house capacity.[40] Findings by ICMA-ACIR researchers indicate a substantially lower incidence of private contracting in this area (234 of the 2,248 cities questioned, or about 10%), though the discrepancy may be explained in part by the fact that the APWA questionnaire asked only for a statement of local policy, not, as in the ICMA-ACIR case, whether the locality was in fact receiving services from a contractor. (See Table I.)

Eight percent of the ICMA-ACIR sample also reported contracting privately for legal services, 4% for planning services, and 1% for public relations services. A number of cities contracted for administrative support services, such as utility billing (4%), payroll (3%), microfilming (2%), tax assessment, tax collection, and treasury functions (all 1%). The principal private providers in many of these cases appear to be local banks. There are over 600 different banks in the U.S. which supply a variety of data processing services to municipalities--especially to smaller cities unable to afford the start-up costs to establish data processing capabilities of their own. A suggestive example of "privatization" in a major jurisdiction is Orange County's transfer of its large and sophisticated data processing operation to a private firm.[41]

In addition to the municipal mass transit case treated above, there are interesting examples of localities and states contracting with private suppliers for skilled management in other areas. One well-known case is North Carolina's 1975 hiring of Health Application Systems, Inc. to administer that state's Medicaid program. In 1972, the city of South San Francisco contracted with a management consulting firm to administer all of its public works operations; and in 1974, San Diego contracted privately for the management of a public housing project.

In two of these cases, results have been inconclusive. Costs in North Carolina were much greater than anticipated, primarily because of an unexpected 13% increase in the recipient population. And the South San Francisco experiment was terminated by "mutual agreement" one year early, largely as a result of negative public reactions, first to a perceived threat to public employee job security, and also to the possibility of conflict of interest inherent in the contract arrangement. The San Diego experiment appears to have achieved some success.

In the case of many services purchased by local authorities from private specialists, cost comparisons are difficult to make, since there are no equivalent public operations. In some instances, nonetheless, comparisons have been made or projected. Thus, Orange County's seven-year, $26.6 million data processing arrangement was expected to produce an $11 million cost saving. And, at the end of the first 60 days, "privatization" of public works management in South San Francisco had saved that city about $20,000 (though it is not clear whether this rate

of savings changed over the foreshortened life-time of the experiment). In North Carolina, despite the financial embarrassment created by unforeseen cost over-runs, both the state and the contractor agree that "privatization" (and, more specifically, computerization of many administrative tasks) has yielded major per claim savings. Finally too, in Ohio, where contracting for tax assessment services is mandatory, costs have been estimated at one-half the average for other states (where private contracting is optional).[42]

The economics of scale suggest that the public market for specialized support services will continue to be an active one, particularly among smaller jurisdictions which seek the benefits of improved technology, but cannot afford major investments in new equipment and personnel.

Social Services

States and localities have always purchased some social services from the private sector--chiefly from non-profit suppliers. During the last decade, the incidence of social service contracting increased dramatically, as officials learned to use the three-for-one-federal-matched provision of the 1967 Amendments to the Social Security Act to expand existing social service programs, whether these were publicly or privately funded. Moreover, the opportunity to expand services quickly, combined with the desire to avoid major investments in developing in-house capabilities, and the need to retain flexibility in the face of anticipated fluctuations in federal funding levels, led many state and local officials to resolve the "make or buy" issue in favor of "buying."

No precise account can be given of the amount or the rate of increase of private purchasing of social services after 1967. However, budget figures for federal expenditures under the major social service titles (IV-A and VI) of the Social Security Act show an increase of nearly 300% between Fiscal Years 1970 and 1975 (from $534.6 million to $1,962.6 million), with by far the largest annual increase (more than $900 million) registered for Fiscal 1972. An analysis of social service costs in that year by Touche, Ross and Co. indicates that total federal, state and local expenditures under Titles IV-A and VI increased 107% over 1971 levels to more than $2.2 billion.

Eighty percent of this increase ($1005.3 million) was comprised by new or expanded purchasing of services. And while the bulk (78%) of this additional purchasing was from other public agencies, fully $221.3 million of the increase was paid to private suppliers--mainly for child (day) care, child foster care, homemaker services, employment and training, and mental health and retardation services. In 1972, the total federal, state, and local expenditure for privately provided social services was $439.9 million, about 20% of all spending.[43] With some exceptions--notably in the cases of day care and homemaker services--this money went to private non-profit, rather than proprietary, providers.[44]

Social services previously addressed by Title IV-A and VI of the Social Security Act were combined under the new Title XX in January 1975. Opportunities for purchase of service contracting were expanded, in part because the eligible population was substantially enlarged, and also because programs supported by federal matching funds were no longer required to be statewide (thus eliminating a bias in the earlier legislation against small providers capable only of servicing a local clientele).

While it is still too soon to gauge the net effect of Title XX on the structure of social service delivery, there are preliminary indications that purchase arrangements (with public and private suppliers) remain the dominant organizational mode. One such indication is the speed at which states have been able to increase spending to claim their full allotments of federal matching funds.[45] In Fiscal Year 1973, only four states were "at ceiling"; in Fiscal 1974 there were six; in 1975, twelve; and by Fiscal 1976 twenty-two states were "at ceiling" with another eight above 90%. It is estimated that in Fiscal 1977, 38 states will qualify for their full federal allotments, and that in the following year this number will increase to 45. It is unlikely that so rapid an expansion of state and local services could be accomplished without major increases in purchasing, especially in view of efforts in many states to limit new hiring.[46]

There is very little data on the comparative cost and quality of publicly and privately supplied social services, owing perhaps to the difficulty of quantifying the intangible benefits which social services produce. However, one study of homemaker services Hennepin County, Minnesota, has estimated the costs of public provision at a third again as much as those projected for private vendors.

Interestingly, Hennepin County homemaker services are supplied by a proprietary contractor. By and large, profit making organizations have remained aloof from the social services

market; a circumstance which seems to owe more to the eleemosynary tradition of social service work, than to economic considerations. In the few cases where commercial operators have undertaken the provision of social services, they seem to have been reasonably successful. And it has been argued that more private enterprise in this area is highly desirable, since proprietary firms may be more strongly motivated than non-profit organizations to limit service costs.[47]

Technological Impediments to Successful Purchasing of Services

Where research, or opportunity and intuition, indicate that "privatization" may be beneficial, there remain two serious obstacles to expanded utilization of the private sector for the delivery of local services. One of these is the technological difficulty, in many cases, of specifying precisely the task to be performed. Inability to define service characteristics may threaten the success of contract arrangements at every stage; or it may be "the primary functional reason" motivating a decision to forego experimentation with alternative methods of service delivery altogether.[48] Secondly, despite the fact that the technology of letting and managing contracts for some services is reasonably advanced, state and local authorities rarely have the personnel or the institutional means to apply what is known. "At these levels," in the words of one experienced observer, "contracting is a backward art."[49] Let us consider these problems in turn.

The difficulty of specifying outcomes varies with the concreteness of service products and with the degree of public consensus on appropriate service goals. Day care or homemaker services, with relatively unmeasurable consequences, pose a larger technical problem for effective contracting than, say, waste collection or street maintenance. Moreover, especially in the case of day care and other social services, the problem of setting performance specifications is compounded by philosophic disagreement on what the most important service objectives ought to be. It should be noted, of course, that neither circumstance is prohibitive. Contracting is certainly possible, indeed, in the case of a number of specialized functions, it has long been practiced successfully, without the precise specification of outcomes. In addition, a fairly persuasive argument can be made that excessively detailed procedural and performance requirements may deter potential providers from entering the market, or drive up service costs unnecessarily.

In general, however, inadequate formulation of service objectives seems to have a broader and a more damaging effect than overspecification on purchase-of-service arrangements.

Thus, for example, the inability of public agencies to specify desired outcomes in drafting requests for proposals may mislead potential suppliers and distort contract bidding at the outset of the purchase-of-service process, and increase the difficulty and the cost of monitoring and evaluation once that process is under way. More importantly perhaps, where the purposes of contracting agencies are unfocused, contract specifications may tend to concentrate on inputs and methods rather than results, on process rather than performance, with two negative consequences. On one hand, as has been suggested, rigid procedural specifications may discourage private entrepreneurs from entering the public service market. On the other, service contracts that compensate primarily on the basis of resources expended rather than results obtained may supply small incentive to reduce costs or increase productivity. In these circumstances, it has been observed, service arrangements are more like grants-in-aid than contracts and impose no special discipline on private providers to pursue cost-effectiveness.[50]

Where feasible, therefore, contracts which tie compensation to levels of performance, while leaving substantial latitude for procedural innovation, may provide a salutary combination of productivity incentives and public accountability for private service producers, and increased discipline on local officials to define community needs and to evaluate contractors' efforts to satisfy them. In practice, performance contracting is very difficult. Objectives must be clearly defined, costs projected, and the public interest protected against contractors' inclinations to make results appear better than they really are. Theoretically, however, and in appropriate circumstances, performance and incentive contracting seem to be the most effective arrangements for evoking the fullest practicable contribution by the private sector to the solution of public problems.[51]

However, building the capacity of local authorities to utilize the private sector depends only in part on the extension and refinement of contracting technology. It is equally important that local governments supply themselves with the means to apply what is known. Here, an essential step seems to be recognition that contract preparation and management is an important and demanding endeavor--one which requires a commitment of resources sufficient either to rent outside expertise as required, or to develop a standing internal capacity. In the latter regard, the creation of a Purchase of Service Office by Hennepin County is an instructive innovation; as is Orange County's hiring of a full-time administrator to monitor the quality of data processing services presently supplied to the County by a private contractor.[52]

But creating institutional mechanisms to amass and apply purchase-of-service technology is not exclusively a responsibility

of public authority. Within the private sector, non-profit or proprietary organizations may also play a creative role: assessing local needs and identifying purchase-of-service opportunities; encouraging local officials to consider multiple service delivery options; developing model contracts and performance evaluation systems; brokering agreements between purchasers and suppliers of services; and even providing services directly under public contract. Unfortunately, until now, experience with private organizations performing such functions has been very limited. Public Service Options, and Public Service Options, Inc., in Minneapolis, seem to represent the sum of the nation's experimentation in this area.[53]

Political Impediments to Successful Purchasing of Services

No comprehensive accounting exists of the impact of federal and state legislation on state and local service contracting.[54] However, the following paragraphs array some apparently representative fragments of the larger picture.

Federal legislation seems to have had a mixed effect on the frequency with which states and localities contract privately for services. Federal laws, for example, have resulted in state prohibitions on local waste disposal practices which threaten the environment and dictated the reallocation of service responsibilities to those providers, whether public or private, who are able to conform to the new standards quickly and economically. Federal legislation affecting state regulation of ambulance services has had a similar result. Suppliers who have been able to upgrade service rapidly and reasonably have survived, or supplanted, those who have not, with public and private agencies among the survivors and the non-survivors.

Federal measures which have increased the discretion of local governments over the local expenditure of federally provided funds carry implicit opportunities for the exploration of new service arrangements. Explicitly, of course, federal recognition of the potential, or even the propriety, of local purchase-of-service arrangements is a relatively late development. Broad Congressional authorization for state and local use of federal funds to buy social services in the private market dates from the 1967 Amendments to the Social Security Act. Even then, however, administrative regulations pursuant to the legislation narrowed the range of opportunity for local contracting by specifying that federal monies could only be used to support state-wide programs and, with respect to certain services (for example, home health care and nutrition for the aged), by prohibiting contractual arrangements with proprietary providers.

Federal intent to enlarge state and local service options is less equivocal in regulations implemented under Title XX, The biases against small contractors and proprietary providers are eliminated, and contracting procedural requirements are simplified.

In the organization of its internal operations, the federal government has had a standing policy of maximum reliance on the private sector since 1955 (Bureau of the Budget Circular A-76).[55] Nominally, government functions may be kept in-house only when cost comparisons favor public rather than private production. In practice, however, the policy is rarely implemented, in part at least because of the difficulty of making accurate public-private cost comparisons, but also because of the persistent and powerful opposition of organized public employees.

Obstacles to purchase-of-service contracting are also posed by state legislation. According to a (1973) study by the National Association of State Purchasing Officials, 15 states have statutes which direct county and city jurisdictions to favor home state labor, products, and contractors in awarding government contracts. In a number of states as well, government contracts are subject to wage laws which, while socially desirable, may further reduce the incidence of service contracting. Other federal, state, and local regulations and practices, too complex and too numerous for full consideration here, also act to dampen the entrepreneurial enthusiasm of potential private contractors. These include the frequent revision by public authorities of program funding levels, client eligibility rules, and rules governing the amortization of providers' investments; costly bidding procedures; stringent financial disclosure and other reporting requirements; bonding requirements; and the imposition of performance criteria not directly related to function.

Whether by accident or design, rules and practices which currently restrict local purchase-of-service options coincide with the interests of constituencies which already occupy the local service territory. It has been observed, for example, that by reducing patronage opportunities "privatization" may cost state and local politicians more politically than they stand to gain from minimizing service costs. In addition, senior and middle level bureaucrats, lulled by job tenure and the absence of economic pressure, may be disinclined to experiment with new service options. But the most intense and most effective opposition to "privatization" has come from the constituency whose interests seem to be threatened most directly when governments divest themselves of current operational responsibilities, or forego acquiring new ones, through purchase-of-service arrangements--public employee unions. In some cases municipal

unions have prevented or even reversed the decision of local authorities to contract for services. In others, as has been observed, union contracts already contain clauses against outside purchase of (public works) services. The official policy of the American Federation of State, County, and Municipal Employees is to press for the inclusion of similar provisions in all public union contracts.[56]

Directions for Further Work and Initiative

Research Needs

There is a pervasive need for more, and more systematic, study of the relative benefits of public versus private provision of municipal and social services. While comprehensive research is useful in cataloging particular examples, revealing general trends, and suggesting the probability of cost savings resulting from switches to private or to public provision, it is not as valuable as case research in determining the most advantageous public-private service mix in a given locality.

In addition, because the circumstances which determine local service costs are constantly changing, comparative cost studies must be repeated at regular intervals. Such a regimen may be beneficial, even when it fails to discover gross inefficiency and to precipitate a reordering of service delivery arrangements, since it may help localities to identify productivity problems and stimulate current providers to greater and more efficient efforts.

Current and future purchase-of-service arrangements should be evaluated, especially those which involve performance and incentive contracts, innovative methods of performance evaluation, and institutional experimentation. Research results, together with other relevant information, should be made readily available to governments at every level of the federal system.

Finally, no systematic effort has been made to identify federal, state, or local legislative and regulatory impediments to effective contracting. Determination of the effects on municipal and social services of current statutory and regulatory measures would be a sensible beginning for any concerted federal effort to expand local service options. Similarly, impact assessments of future measures would be an important component of any extended federal or state effort in this area.

Differences in the research interests and capabilities of federal, state, and local governments suggest that some distribution

of the diverse research tasks outlined above may be in order. Clearly, the federal government has an important role to play in stimulating the states and localities to explore alternative service delivery methods: first, by adopting the service options idea as an article of national policy; and then by undertaking directly or indirectly to evaluate innovative purchase-of-service experiments conducted by the states and localities, and by insuring that the service-options-information-clearinghouse function is performed at the national level either by a federal agency or by one or more of the major "public interest groups."

State and local governments are better situated than the federal government to implement a case research strategy for determining comparative advantages and disadvantages of "privatization." Here, federal concern and leadership might be expressed through grants to increase the capabilities of planning departments and even to encourage the creation of purchase-of-service offices in sub-national jurisdictions.

Insofar as they seek to identify local purchase-of-service opportunities, as well as to broker and participate in purchasing arrangements, private sector organizations (whether non-profit or proprietary) may also carry out important comparative research on the benefits and liabilities of alternative service delivery mechanisms. On its part, the public sector may stimulate this effort through the provision of grants to non-profit researchers, or by renting the expertise of commercial consultants.

Technological Development and Technical Assistant Needs

Circumstances may confound local purchase-of-service arrangements, even where case research has indicated the likelihood of cost and/or quality improvements, in the absence of careful drafting and close monitoring of service contracts. If the private sector is to be put to the most productive use in meeting local service needs there must be an increased emphasis on the development of contracting and contract management capacity at every level of the federal system, but especially among state and local governments. Moreover, within the context of this general effort, special attention should be accorded to developing expertise in the difficult and demanding areas of performance and incentive contracting.

Encouragement and support should also be supplied to those agencies, whether public or private, which are attempting to develop and disseminate model service contracts and information on alternative contracting procedures to interested jurisdictions.

Good contracting and contract management, as well as objective comparisons of competing service options, also require new efforts to develop well defined and widely applicable performance measurements across the whole spectrum of social and municipal services.

In the development and application of new public management technology, as in the allocation of service-options-research responsibilities, the several levels of American government, together with the private sector, may have complementary parts to play. In general, the development of local (or state) capacity to apply what is known about service contracting must be the responsibility of local (or state) authorities, joined by concerned private sector organizations. The most effective exercise of this responsibility, on the public side, may entail a substantial "front-end" commitment of resources and even some modest institutional innovation. Similar efforts may also be desirable on the private side. In both cases, and especially in the former, federal and state governments can support state and/or local efforts through the provision of planning, technical assistance, and management-capacity-building grants. In the latter case, private non-profit organizations may be established, with the help of foundation grants and corporate contributions, to encourage the exploration of local service alternatives and to generate, store, and supply useful purchase-of-service information and expertise. Private consulting firms may seek to develop similar capabilities as a commercial venture.

Federal and state governments might also support the development of better performance measurements either directly, by supporting research by public or private agencies, or indirectly, by encouraging states and localities to experiment with performance and incentive contracting. In the latter cases, contract negotiators (and/or drafters of requests for proposals) would automatically be forced to define mutually understandable and acceptable performance goals and methods of evaluation.

Model contracts and detailed advice on the structure and implementation of contracting procedures might be developed by public agencies at every level of government, as well as by national purchasing officials' associations and other private non-profit organizations.

Institutional Needs

At the local and even the state level, a full and effective commitment to explore a variety of municipal and social service options, and to bring available contracting and contract management technology to bear in cases where the purchasing of services seems advisable, may entail the creation of an institutional capacity and a formal assignment of responsibility. In particular, purchase-of-service offices within state and local governments could act as repositories for information and expertise gained from purchasing experiments in their own and in other jurisdictions. Such offices might also advise line agencies in deciding when to contract out, draft requests for proposals and contracts themselves, and help in the development

of performance evaluation systems. In a similar vein, it may be advisable to increase the staff of state and local planning offices to facilitate the evaluation of local service delivery by private contractors and public agencies alike.

On the private side, organizations like Public Service Options seem to perform an important "priming" function at the local level--assessing service needs and identifying opportunities for innovative delivery methods, lobbying local officials, brokering contract arrangements, and contributing generally to the local store of information and expertise in the implementation of public service alternatives.

The adjustments and innovations in public institutions which have been reviewed in this section are clearly the responsibility of the governments involved, primarily state and local jurisdictions. Federal encouragement might again take the form of planning, technical assistance and capacity building grants-in-aid. Also, once the utility and the replicability of the Public Service Options experiment has been satisfactorily determined, the federal government might take an active part in persuading business organizations and foundations to support similar undertakings in other metropolitan areas. In addition, the federal government might encourage business firms to allocate resources--at first, perhaps, as an exercise of "corporate social responsibility"--to the search for commercial opportunities in the public service area.

Finally, federal and state governments might scrutinize and, where appropriate, amend present legislative and regulatory measures which hamper the broad exercise of state and local service options. The probable impacts of proposed laws and regulations affecting local services might be assessed from the same perspective as part of the rule-making process itself.

The Foundation of a General Strategy for Increased Utilization of the Private Sector in Meeting Local Service Needs

Existing research reveals a prevalent reluctance on the part of local jurisdictions to transfer responsibility for delivering traditional municipal services from the public to the private sector. Across this range of services at least, organizational patterns remain relatively static. Those functions which have been traditionally performed by private business continue to be performed that way; those which governments have performed remain within the province of government. The mix may vary from locality to locality, but the reallocation of traditional service responsibilities in any particular locality is a rare occurrence. Thus, with certain exceptions--in those

cases, for example, where switching promises clear and substantial productivity gains, where human and material costs resulting from labor dislocations and idled plants are limited, and where political opposition is not severe--the greatest opportunity for experimentation with alternative methods of service delivery may lie beyond the range of established municipal functions. It may be advisable, therefore, to concentrate efforts to expand local service opportunities in those areas where the private sector has traditionally played an active part, or where the demand for core services exceeds the response capacity of local authorities, or where there is a market for services that are more flexible and variegated than those normally provided by public agencies, or where new service needs have been created by law or generated by the development of new technologies. Both the public and private sectors should be sensitive to the need to identify and capitalize upon these opportunities.

NOTES

1 Donald M. Fisk, et al., p. 2.

2 Joseph F. Zimmerman, "Meeting Service Needs Through Intergovernmental Agreements," (Wash., D.C.: International City Management Association), pp. 79-88.

3 Local Public Works Organizations: A Survey-Report on Management Personnel, Allocation of Functions, and Related Information, Special Report No. 35 (Chicago: APWA), pp. 94-98.

The National Science Foundation is supporting three research projects which attempt to deal comprehensively with purchase-of-service contracting: for solid waste collection and disposal (Columbia University), police services (Indiana University), and fire services (Research Triangle Institute). Only the first of these, however, is concerned specifically with comparing public and private service delivery mechanisms.

4 Zimmerman, pp. 84-85. This survey, which measures the incidence (though not the degree) of service contracting by 1393 municipalities, shows more cities entering agreements with private suppliers than with other government entities in only 12 of 76 functional areas. The survey also reveals that, even in areas where private or intergovernmental service agreements are most common (the provision of jails, police training, street lighting, and waste collection and disposal), no more than 20% of all (2,248) cities surveyed reported using them. That is to say, most local governments choose to provide most services themselves.

5 Thus, for example, a well-known study by the New York City Administrator's Office in 1970 showed the cost per ton of solid waste collection by the Department of Sanitation to be almost three times the cost per ton of private collection. A subsequent analysis of the same data by the City's Environmental Protection Agency found the cost advantage of "privatization" to be substantially less, though still very large.

6 Privatization, an unpublished report prepared for the National Commission on Productivity (undated), p. 10.

7 Fisk, p. 150.

8 Thus, for example, social services, supplied locally but supported in large part by the federal government under TitlesIV-A and VI, and now Title XX, of the Social Security Act, have been a fertile field for non-profit organizations.

9 In regard to the latter point, however, experience suggests some interesting exceptions. Certain goods which seem public in character--for example, extra police services or parks and other recreational facilities maintained for private subscription--can still be restricted for the benefit of limited populations. In some cases, the supply of such quasi-public goods, while necessarily subject to certain kinds of public regulation, is beyond the appropriate range of local public responsibility. In others, it is simply beyond local capacity.

10 Moreover, in regard to most contracted functions, local jurisdictions enter purchase agreements more frequently with other units of government than with private suppliers. See note 4, above.

11 E. S. Savas, and C. Neimczewski, "Who Collects Solid Waste?" reprinted from The Municipal Yearbook 1976 (Wash., D.C.: ICMA), Tables 1/4 and 1/5.

12 However, if the market is defined in terms of numbers of people rather than numbers of jurisdictions the percentages are reversed, since the likelihood of some direct municipal collection increases with city size. Thus, of the (nearly 52 million) people living in sampled cities, 65.4% have the option of municipal collection of some or all residential "mixed refuse," while private service is available to only 47%. In those (1607) jurisdictions serviced either by public or private providers (but not both), direct public collection is available to 61.3%, and private collection to only 36.0% of all residents. (Savas and Neimczewski, Tables 1/2, 1/3, 1/5). Population estimates are based on 1970 census data. Also, while the figures used here relate solely to arrangements for the collection of residential "mixed refuse," the Columbia study also treats the collection of other categories of solid waste.

13 Fisk, pp. 29-30.

14 Ibid., p. 47. It is interesting to note that since the publication of these estimates, Winnepeg's public employee unions have cooperated with city officials to produce significant increases in the productivity of municipal waste collection (Conversation with Winnepeg's Assistant Director of Public Works).

15 Fisk, p. 30.

16 Letter from Don Wasserman, Director of Research, American Federation of State, County, and Municipal Employees.

17 E. S. Savas, et al., Evaluating the Organization of Service Delivery: Solid Waste Collection and Disposal, a summary of an interim report on research underway at Columbia University Graduate School of Business (New York City: Center for Governmental Studies, Columbia Univ., August 1976), p. v.

18 Ibid., pp. vi-vii. The interim findings of the Columbia study have been challenged on a number of technical statistical grounds (e.g. sample composition, extrapolation), and with regard to the precision of key variables (e.g. number of household served in collections at multi-family dwellings). One of the most perplexing aspects of the report, however, results from its finding that 50.8% of cities with municipal collection of residential refuse have a pick-up frequency of twice-a-week or more. Only 26.4% of cities with non-public collection have comparable pick-up frequencies. In the view of the Columbia investigators, the higher frequency of municipal pick-ups is a case of government overproduction. And no allowance for the resulting cost appears in their explanation of service cost differentials. One critic of the interim report has suggested, however, that if service frequency is held constant, the Columbia data indicate that the mean cost per household is no greater for municipal than for contracted collection.

19 The Columbia study does not, however, consider cities above 750,000 population. Moreover, its findings with respect to the unlikelihood of achieving scalar economies as recipient populations rise above 50,000, have been challenged.

20 On balance, despite the intensity of the dispute over much of the evidence on comparative carting costs, a good deal of the comprehensive research in this area seems to favor purchase-of-service contracting. On the other hand, there are numerous individual cases in which direct municipal collection has been shown or estimated to be less costly than private collection. For this reason perhaps, an impartial observer might intuit some correlation between an anti-contracting bias and the call for more case studies, and, vice versa, between a pro-contracting preference on the inclination to undertake comprehensive research. Nonetheless, the expanding body of important and highly suggestive comprehensive research on the organization of waste collection can establish only the probability that contracting produces cost savings in certain local contexts. Individual case studies are still necessary to determine whether cost or other considerations make contracting a desirable option for specific jurisdictions.

21 APWA, p. 96.

22 Ibid., p. 97.

23 It was estimated that 8-inch reinforced concrete paving would cost 11.3% less, and asphalt resurfacing 24.8% less if the city contracted these functions out to private firms. In maintaining streets, it cost the city $13.59 per ton to provide new road surfaces 1 inch thick; while the cost for private resurfacing (1 1/2-1 3/4 inches thick) was $8.12 per ton. For 6-inch water main construction city costs exceeded contractors' costs by 15.6%; for 10-inch sewer main construction, by 25.3%; and for 6-inch water main renewal by 14.1%. Fisk, p. 47.

24 Ibid., p. 48. The Winnepeg City Council authorized an additional two-year study to monitor comparative service costs. While this study is likely to be extended for an additional year, preliminary results seem to indicate that the city is more competitive in some areas than had been supposed.

A cost comparison similar to that conducted in Winnepeg was completed in a second Canadian city, Thompson, Manitoba, in 1971. Based on this study recommendations were made that the city contract out for sidewalk and curb construction, sewer line replacement, and building services, but continue its asphalt operations.

25 E. S. Savas, "Municipal Monopolies Versus Competition on Delivering Urban Services," in Willis D. Hawley and David Rogers, Improving the Quality of Urban Management (Beverly Hills: Sage, 1974), p. 491.

26 The New York Post, May 10, 1972.

27 J. Kakalick and S. Wildhorn, The Private Police Industry, Its Nature and Extent, Vol. 2 (Santa Monica: Rand, 1972), pp. 10-12.

28 Ibid., pp. 12-13.

29 Fisk, p. 63.

30 Volunteer departments outnumber regular municipal departments in America by 18,000 to 1,300 (Fisk, p. 64).

31 Ibid., p. 76, citing Dunlop and Associates, Economics of Highway Emergency Ambulence Service, Vol. 1 (Darien, Conn.: National Technical Information Service), p. 11. Only 17% of the cities responding to a 1970 ICMA survey reported contracting privately for ambulance transportation, and only 15% contracted for emergency ambulance services (Fisk, p. 68). An even smaller percentage (2) of the ICMA-ACIR sample contract for ambulance services of any kind (See Table I, above).

32 Fisk, p. 86.

33 Zimmerman, p. 85.

34 In the latter regard, see Clarence Shallbetter and Gary G. Herzberg, Shared Ride Services (Minneapolis: Public Service Options, July 1975).

35 About a third of the total number of proprietary schools are cosmetology (or beauty) schools; another third are trade and technical schools; and the remainder are business and correspondence schools. Annual enrollment in "the proprietaries" is over 3 million, though (about 1000) correspondence schools account for two-thirds of this number. By one estimate, annual gross revenues amount to at least $2.5 billion. See Wellford Wilms, Public and Proprietary Vocational Training (Berkeley, Calif.: Center for Research and Development in Higher Education, Univ. of Calif., Berkeley, 1974), pp. i-iii, 2.

36 Ibid., p. ii.

37 Edward M. Gramlich and Patricia Koshel, Education Performance Contracting (Wash., D.C.: Brookings, 1975), pp. 73-74.

38 Fisk, pp. 123-126.

39 See Daniel Weiler, A Public School Voucher Demonstration: The First Year at Alum Rock, Summary and Conclusions (Santa Monica: Rand, 1974).

40 APWA, pp. 94-95.

41 To avoid the rapidly rising cost of maintaining its own data processing department, the County, after a lengthy and meticulous selection process which included competitive bidding, awarded a seven-year contract. The contractor took over all the County's equipment and programs. It also hired 147 of the 150 data processing people previously employed by the County (the remaining 3 took other county jobs). See Fisk, pp. 110-114.

42 The quality of this service, however, has been severely criticized. See Fisk, p. 118.

43 A 1970 survey of social service purchasing in three states by Booz, Allen, and Hamilton, Purchase of Social Services (Springfield, Va.: National Technical Information Service, 1971), p. 11, found that a comparable proportion of total expenditures (10%-15%) went to non-public agencies. Cited in Fisk, p. 91.

44 Touch, Ross, and Co., Cost Analysis of Social Services, Fiscal Year 1972 (Wash., D.C.: Social and Rehabilitation Service, February 1973), pp. 2, 23.

45 Title XX limits the overall federal contribution to $2.5 billion while limits on state shares are fixed in relation to population.

46 However, according to preliminary findings of a current Urban Institute study of operations under Title XX in five states, those states which are already at "ceiling" may have curtailed their purchasing of services somewhat as a result of mounting inflation, the pressure of increased administrative costs, and the militancy of organized public employees.

47 Citizens League, Why Not Buy Service? (Minneapolis: Citizens League, September 1972), p. 14.

48 William Niskanen, Bureaucracy and Representative Government (Chicago: Aldine-Atherton, 1971), p. 20.

49 Lyle C. Fitch, "Increasing the Role of the Private Sector in Providing Public Services," in Hawley and Rogers, p. 546.

50 Citizens League, Overcoming Obstacles to the Purchase of Service (Minneapolis: Citizens League, January 1974), p. 16.

51 Performance contracts predicate payment on the achievement of specific outcomes. For example, an agreed sum might be paid for each child schooled to a certain level of reading or mathmatical competence--with no payment where test scores fell below this level. Incentive contracts are fixed-cost arrangements with bonuses for the maintenance of high service quality or improved productivity.

52 The Hennepin County Purchase of (social) Service Office has defined the sphere of its own operations to include: primary responsibility for developing requests for proposals, once operating departments and the County Administration, with the advice of the Purchase of Service Staff, have determined that particular services should be purchased; primary responsibility for coordinating the selection of service providers (by operating departments and the County Administration) and the negotiation of purchase-of-service contracts; and monitoring the efforts of the county Planning Staff, operating departments, and prospective service providers to develop appropriate evaluation systems. Implicit in the assignment of these duties, of course, is the general and continuing obligation to cultivate the skills necessary for their execution.

Before the establishment of the Purchase of Service Office, Hennepin County had no institutional mechanism for coordinating the purchase of social services. The County's position was generally that of respondent to unsolicited proposals, specifying services to be supplied and clients to be served. See Recommended Procedures for Social Services Contracting in Hennepin County, a draft report prepared jointly by the Hennepin County Purchase of Service Office and Public Service Options (September 1976).

53 Public Service Options is a foundation-funded "national demonstration project" established in the summer of 1974 "to develop new options in the delivery of public services," for the Minneapolis-St. Paul area. Public Service Options, Inc. was created in April 1976 as "the contract/implementation arm" of Public Service Options in anticipation of a contract with the Twin Cities Metropolitan Transit Commission "for design and development of a privately operated shared ride demonstration project in southern Hennepin County," and other, future contracts. Letter from John Carpenter, Associate Director of Public Service Options, and the PSO Project Information Sheet.

54 Such an assessment would, of course, be a useful prelude to any concerted federal or state effort to expand the service options of sub-national jurisdictions. It has been suggested that this effort might also entail a requirement that all enactments and regulations affecting state and local service delivery be accompanied by a "purchase-of-service impact statement."

55 The most recent reaffirmation of federal policy in this area is an OMB memorandum, dated July 27, 1976, directing executive agencies to implement procedures "to insure that all in-house commercial and industrial activities are reviewed and terminated if not justified as an exception to the existing contracting out policy."

56 The official position of the American Federation of State, County, and Municipal Employees with respect to service contracting is adamant: "That all AFSCME Councils and Locals resist efforts to contract out" any public work that has traditionally been performed by public employees; and "That whenever possible, AFSCME affiliates negotiate strong no-subcontracting and successor provisions and strengthen layoff protections in their bargaining agreements." (Resolution No. 19, adopted at AFSCME's 22nd International Convention, June 14-18, 1976) In a less formal and somewhat more qualified pronouncement, a senior AFSCME staff member has remarked that: "It may well be that some innovative service delivery options should be tried by the public sector to better capture or take advantage of its [sic] competitive elements, economies of scale, or its other advantages."

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